KORG®

PERFORMING KEYBOARD
SERVICE MANUAL TRIDENT

CONTENTS

KEIO ELECTRONIC LABORATORY CORPORATION
TOKYO/JAPAN

1. SPECIFICATIONS

KEYBOARD . . . . ● C ~ C, 61 Keys, 8 voices

SYNTHESIZER SECTION (*this marked facilities are programmable)
VCO-1* . . . . ● Scale (16', 8, 4')
    ● Waveform (ᴎ , ⊓_ , PW, PWM)
    ● PW/PWM Intensity
    ● PWM Speed
VCO-2* . . . . ● Scale (Off, 16', 8', 4')
    ● Waveform (ᴎ)
    ● Detune
VCF* . . . . ● Cut-off Frequency
    ● Resonance
    ● EG Intensity
    ● KBD Track (Off, Half, Full)
VCA* . . . . ● EG Mode (∧─ , ∫ ⌐)
ENVELOPE GENERATOR . . . . . ● Attack
    ● Decay
    ● Sustain
    ● Release
VCO-2 . . . . ● Detune Memory (On/Off)
ENVELOPE GENERATOR . . . . . ● Solo Release (On/Off)
PROGRAMMER (x16) . . . . ● Program Select (1 ~ 8)
    ● Bank Select (A, B)
    ● Manual
    ● Write
    ● Memory
    ● Protect (On/Off)
PRESET (x3) . . . . ● Piano-1
    ● Piano-2
    ● Clav
MIXER . . . . ● Output (On/Off)
    ● Volume

BRASS SECTION
SCALE (x2) . . . . ● 16', 8'
VCF . . . . ● Cut-off Frequency
    ● Resonance
    ● EG Intensity
ENVELOPE GENERATOR . . . . . ● Attack
    ● Decay
    ● Sustain
    ● Release
TRIGGER . . . . ● Multiple Trigger (On/Off)
    ● Trigger Select (On/Off)
    ● Silence Note (2, 4, 6, 8)
MIXER . . . . ● Output (On/Off)
    ● Volume

STRINGS SECTION
SCALE (x3) . . . . ● 16', 8', 4'
ENVELOPE GENERATOR . . . . . ● Attack
    ● Release
EQUALIZER . . . . ● High
    ● Low
EFFECT . . . . ● Bowing (On/Off, Level, Tone)
    ● Vibrato (On/Off, Delay Time, Intensity, Speed)
    ● Ensemble (On/Off)
FILTER . . . . ● KBD Balance
MIXER . . . . ● Output (On Off)
    ● Volume

TOTAL CONTROL SECTION
KEY ASSIGNOR . . . . ● Assign Mode (1, 2)
KEYBOARD SPLIT . . . . ● Synthe (L, L+H, H)
    ● Brass (L, L+H, H)
    ● Strings (L, L+H, H)
PITCH CONTROL . . . . ● Tune (±100 Cents)
VIBRATO . . . . ● Delay Vibrato (On/Off)
    ● Intensity
JOY STICK . . . . ● Pitch Bend (X-Axis)
    ● Vibrato Depth/Trill Depth (Y-Axis)
    ● Intensity
    ● Speed
FLANGER . . . . ● Select (Synthe, Brass, Strings)
    ● Manual
    ● Intensity
    ● Feedback
    ● Speed

VOLUME CONTROL . . . . ● Total Volume
    ● Headphone Volume
POWER SWITCH . . . . ● Power (On/Off)

INPUT & OUTPUTS
OUTPUTS . . . . ● Mix Outputs x2 (High, Low)
    ● Separate Outputs x3 (Synthe, Brass, Strings)
    ● Headphone Output (Stereo)
INPUTS . . . . ● Synthe VCF fcM In (−5V ~ +5V)
    ● Damper (⌐ʟɢɴᴏ)
    ● Brass VCF fcM In (−5V ~ +5V)
    ● Brass Trigger In (⌐ɢᴠᴅ)
    ● Total Expression (0 ~ +5V)
    ● Separate Expression x3 (0 ~+5V)
DIMENSIONS . . . . ● 1012 (W) x 52 (H) x 524 (D) mm
WEIGHT . . . . ● 21 kg
ACCESSORIES . . . . ● Connection Cord
    ● Dust Cover
    ● Foot Switch S-1
POWER CONSUMPTION . . ● Voltage (Local Voltage, 50/60Hz)
    ● Wattage (41W)

2.STRUCTURAL DIAGRAM

PART NO.	PART NAME	REMARKS
1	Wooden case	KOC-D20021
2	Front panel	KOC-C20095
3	Metal fitting of front panel (R)	KOC-C30161
4	Metal fitting of front panel (L)	KOC-C30161
5	Phone jack plate	KOC-C30160
6	Music stand	KOC-C30162
7	Metal fitting of control panel	KOC-C40229
8	Joystick VR mounting board	KOC-C40230
9	Control panel	KOC-E40068
10	Joystick knob	KOC-E40035
11	Metal fitting of KLM 297 (U)	KOC-C40350
12	Metal fitting of KLM 297 (L)	KOC-C40350
13	Radiation mask	KOC-F40161
14	Serial number plate	KOC-F40050, H40001
15	Fuse seal	KOC-F40057
16	Rotary knob	18φ X-1936

3.BLOCK DIAGRAM

JOYSTICK

MG

KLM-291

KLM-298,299

KBD MATRIX

KLM-300

KEY ASSIGNER

KBD SPLIT

PRESET

KLM-317

PROGRAMMER

KLM-292

VCO 1

ANTI LOG AMP

VCO 2

KLM-301

MOD.

MFX CV

VCF STRINGS

KLM-317

GATE BRASS

MPX EG

VCF BRASS

EG BRASS

VCA BRASS

MPX EG

VCA STRINGS

KLM-293

VCF SYNTHE

VCA SYNTHE

EG SYNTHE

KLM-302

COMPR-ESSOR

EXPANDER

BOWING

VIBRATO

ENSEMBLE

EQUALIZER

KLM-294

MIXER

VOLUME OUTPUT

SELECTOR

FLANGER

EXPRE-SSION

KLM-291

POWER SUPPLY

KLM-297

- - - - - ▷ CONTROL VOLTAGE

————▷ AUDIO SIGNAL

3

4.CIRCUIT DIAGRAM
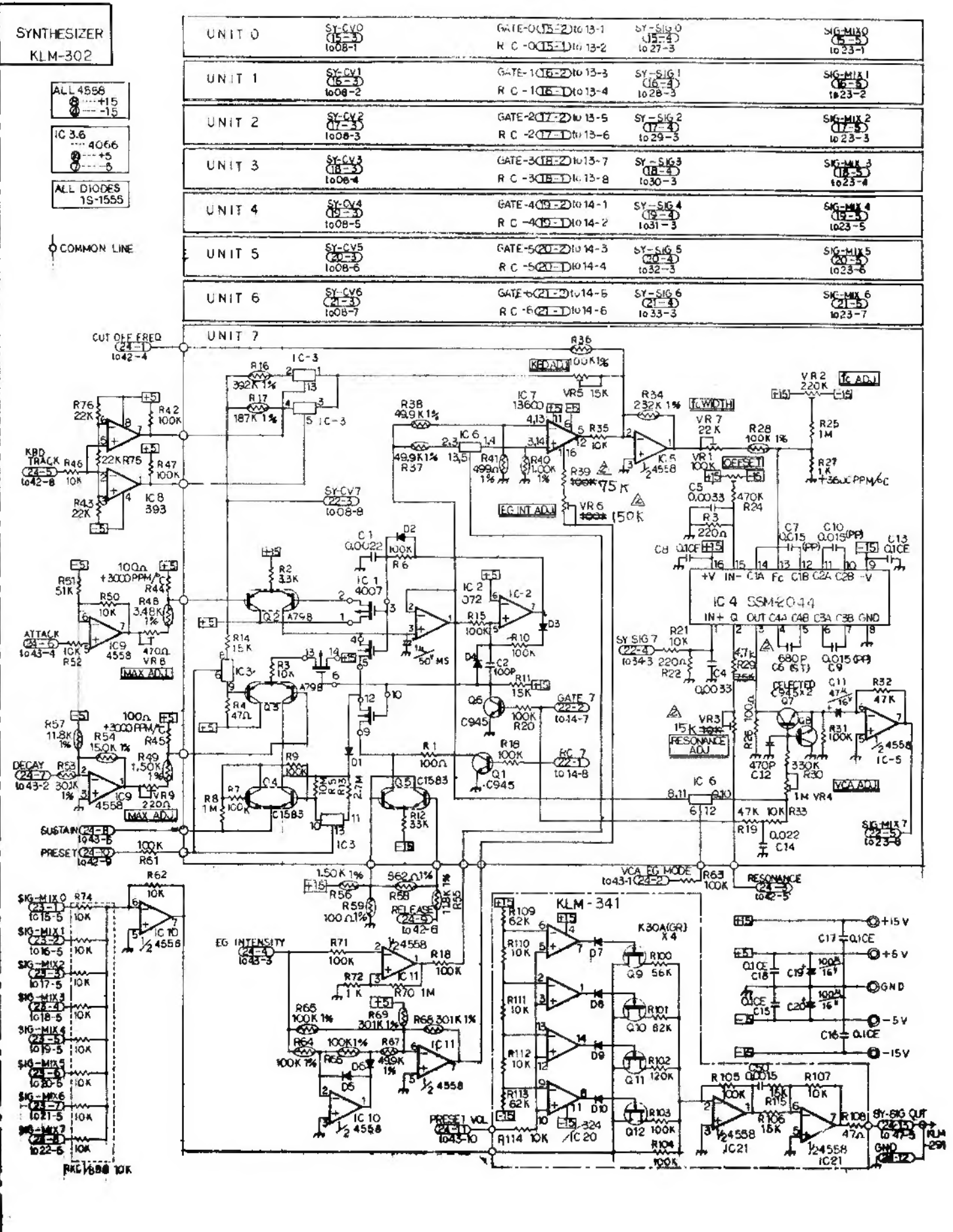
KLM-298   KLM-299   KLM-300

KLM-292

KLM-301   KLM-302
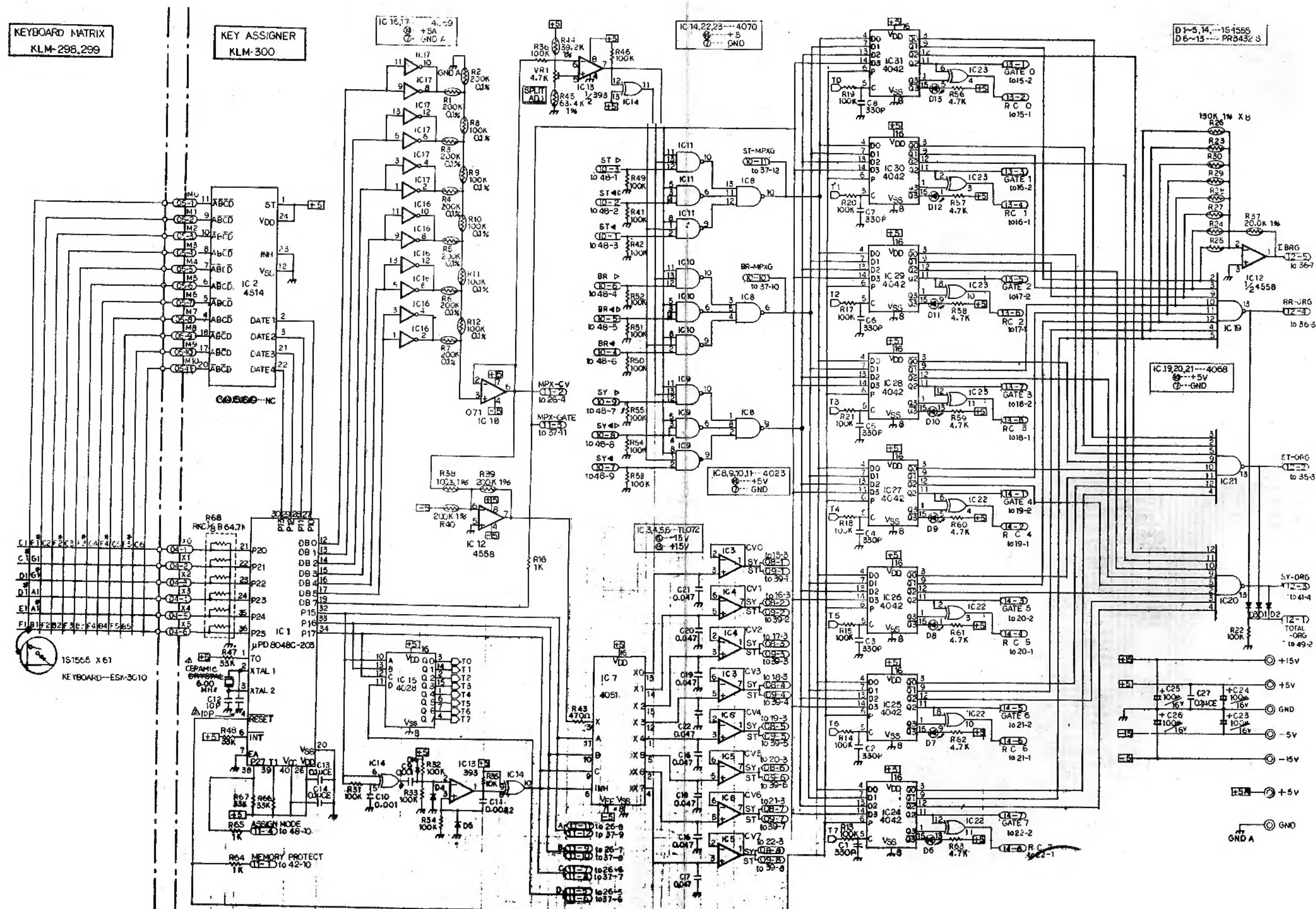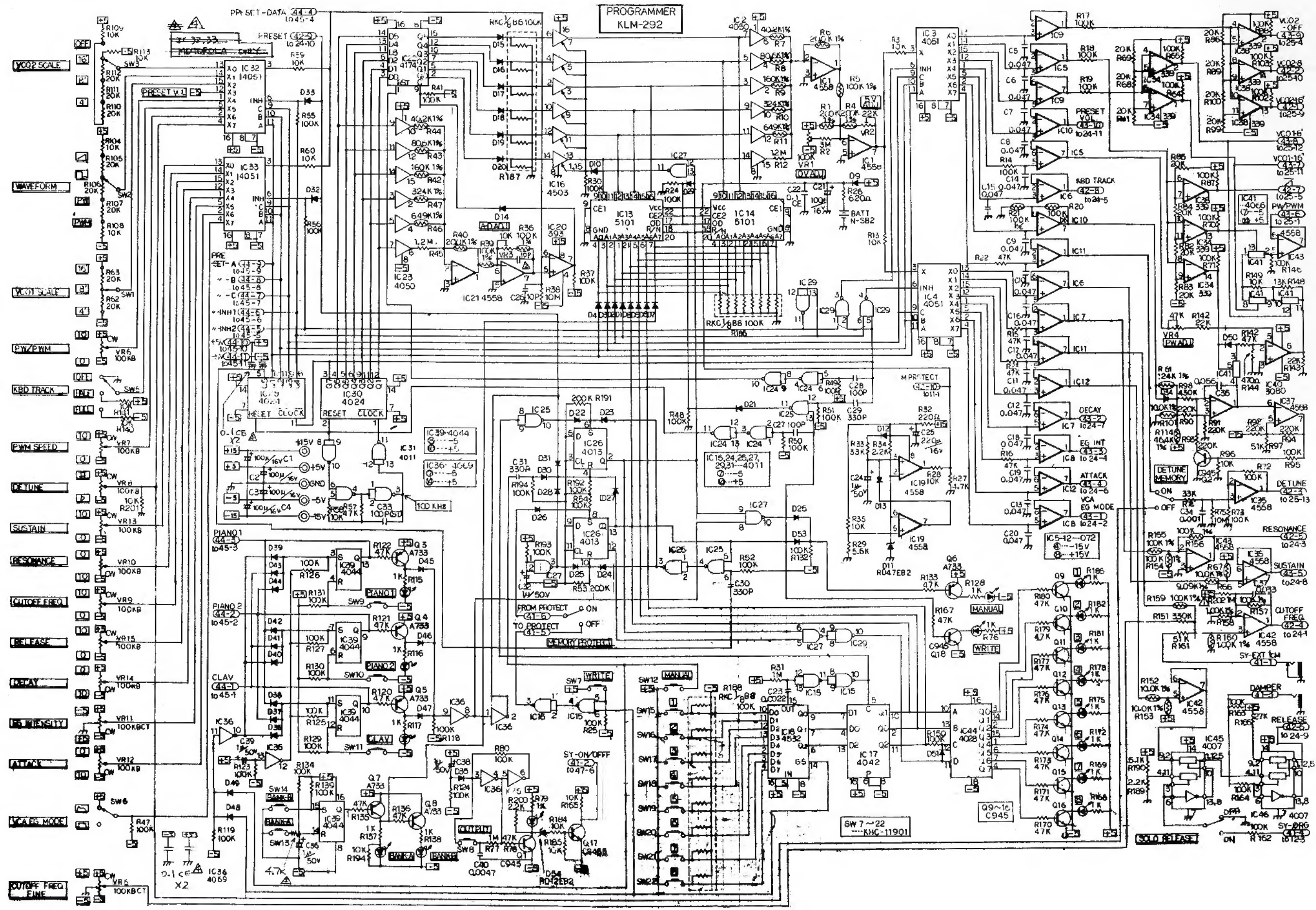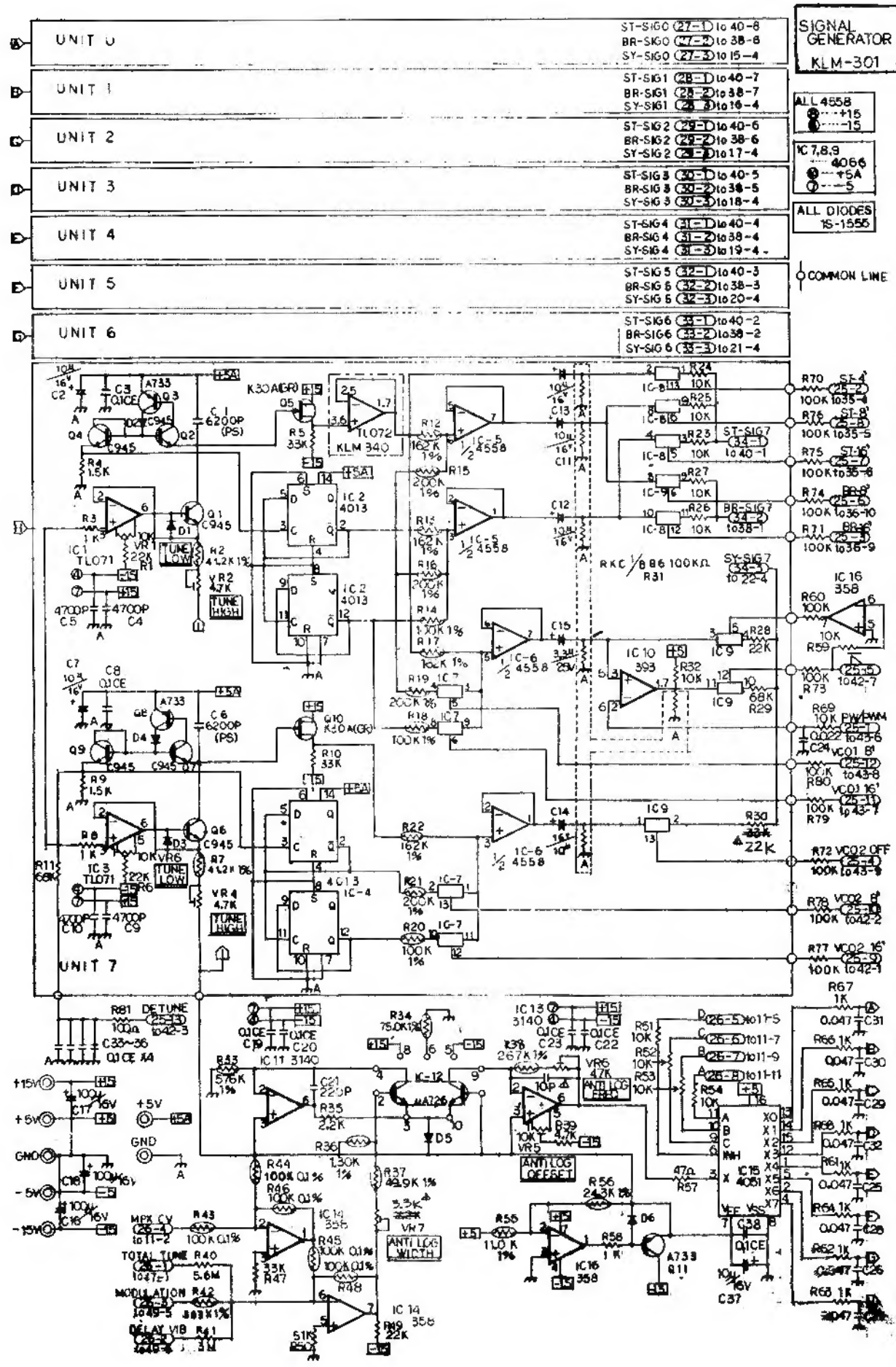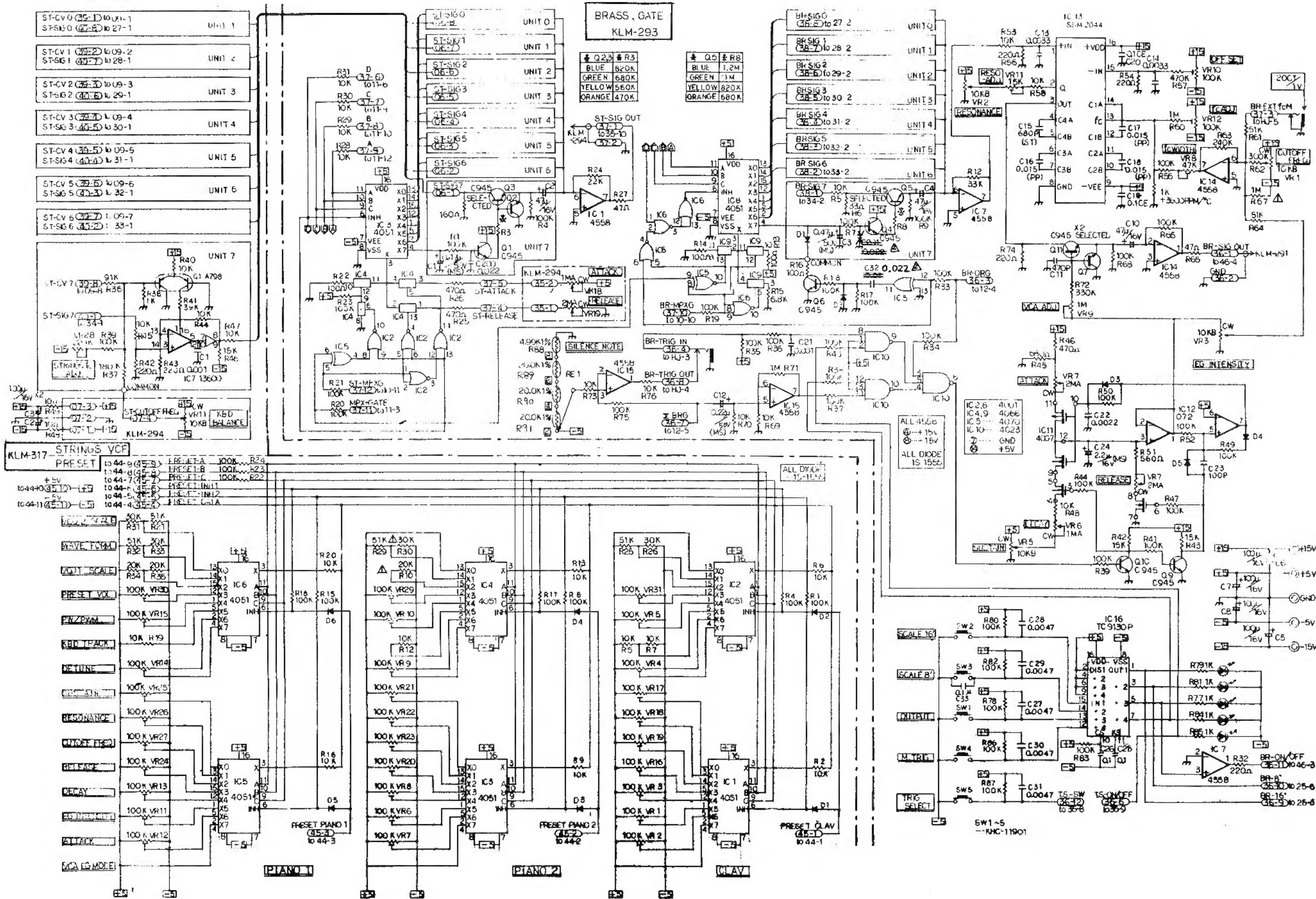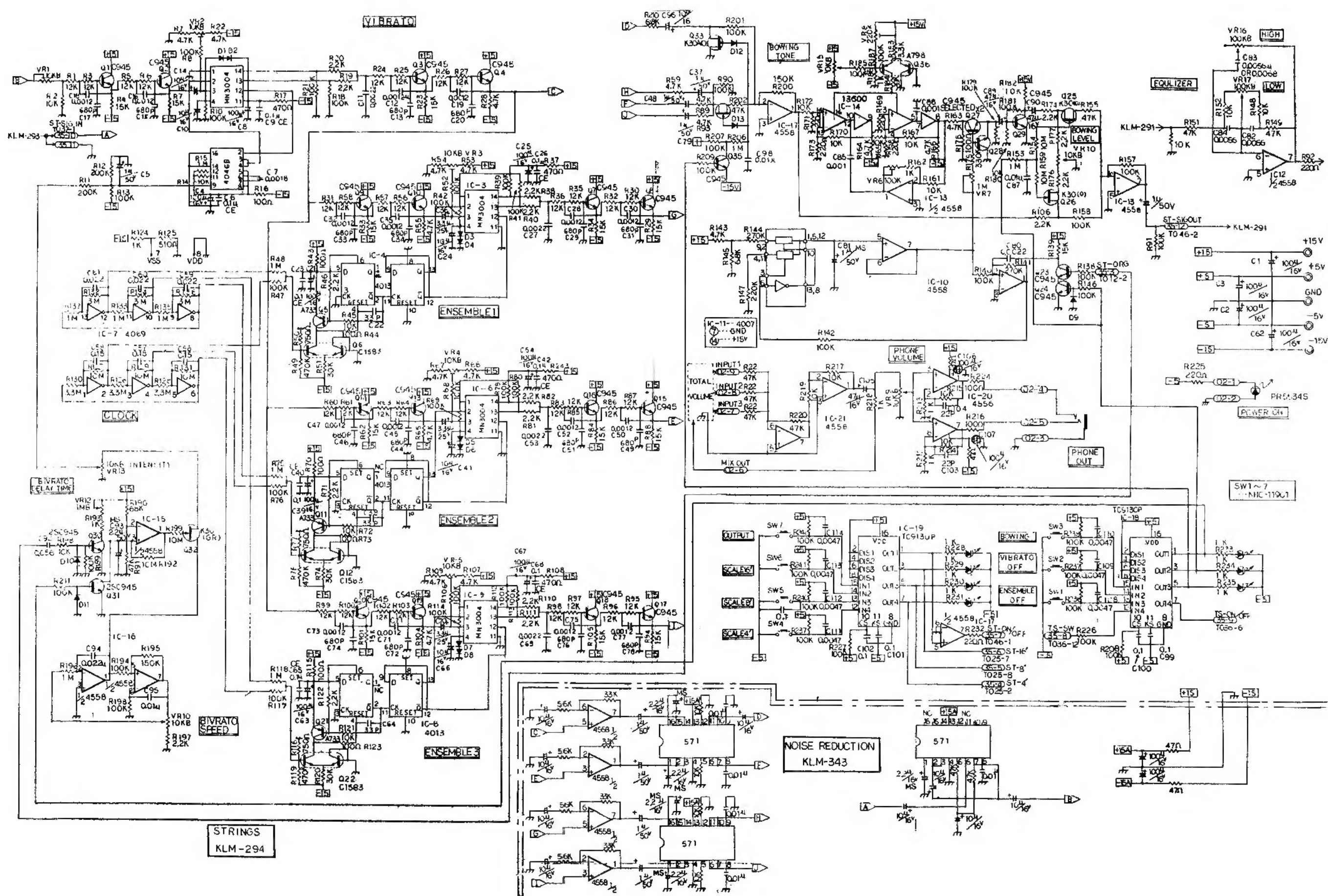
STRINGS
KLM-294
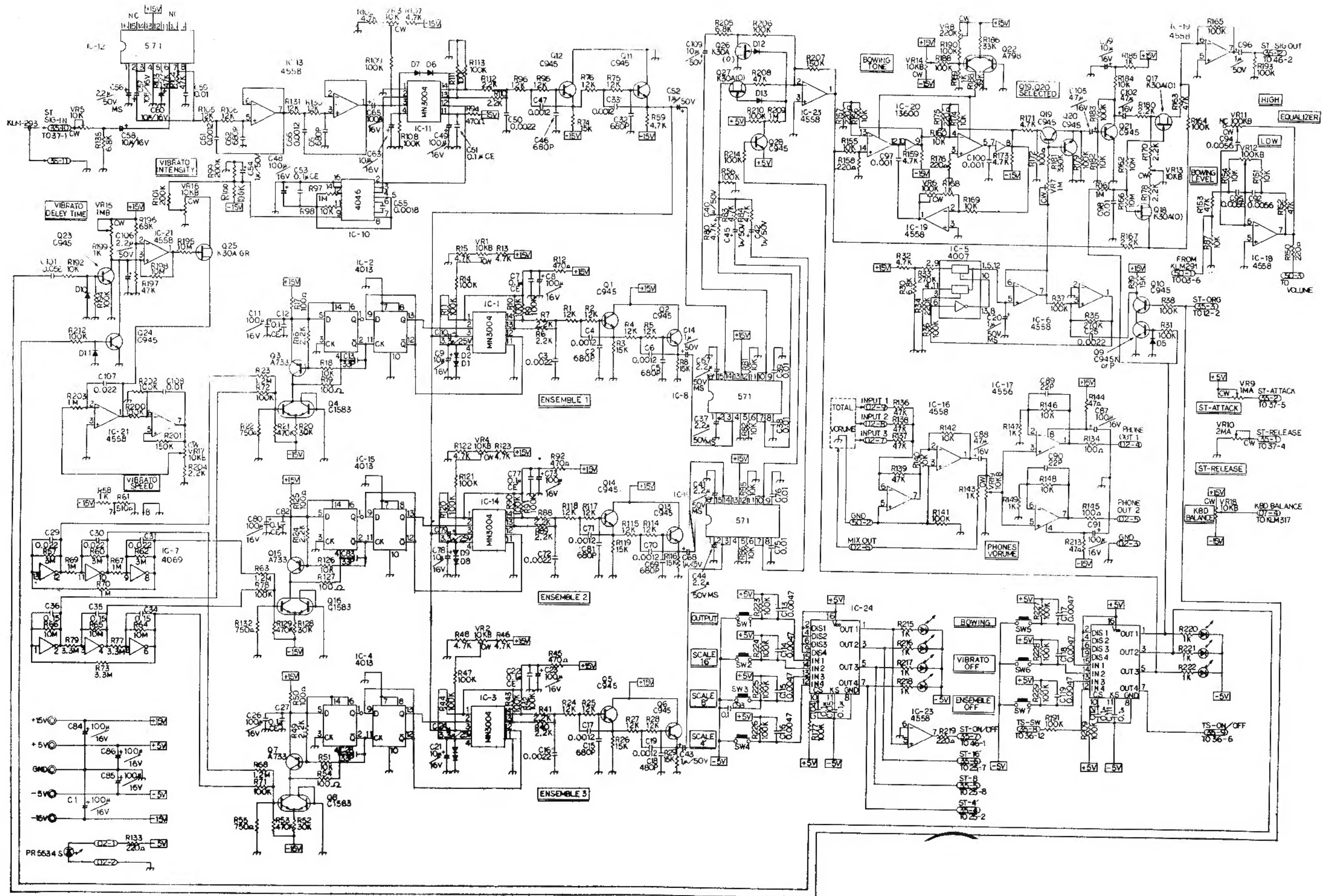
KLM-291   KLM-297

5.PC BOARD

KLM-291 FRANGER
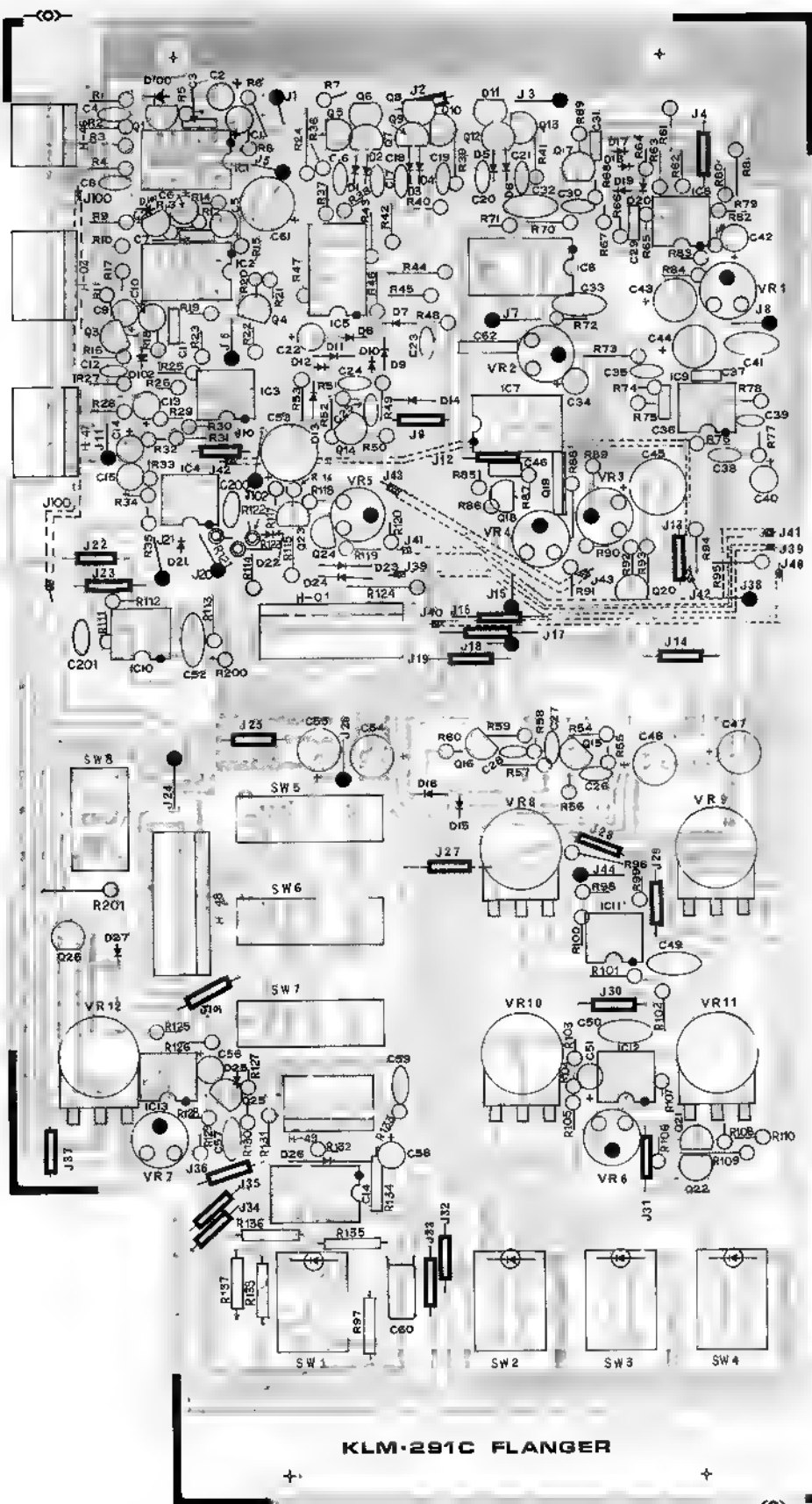
KLM-292 PROGRAMER

KLM-291C FLANGER
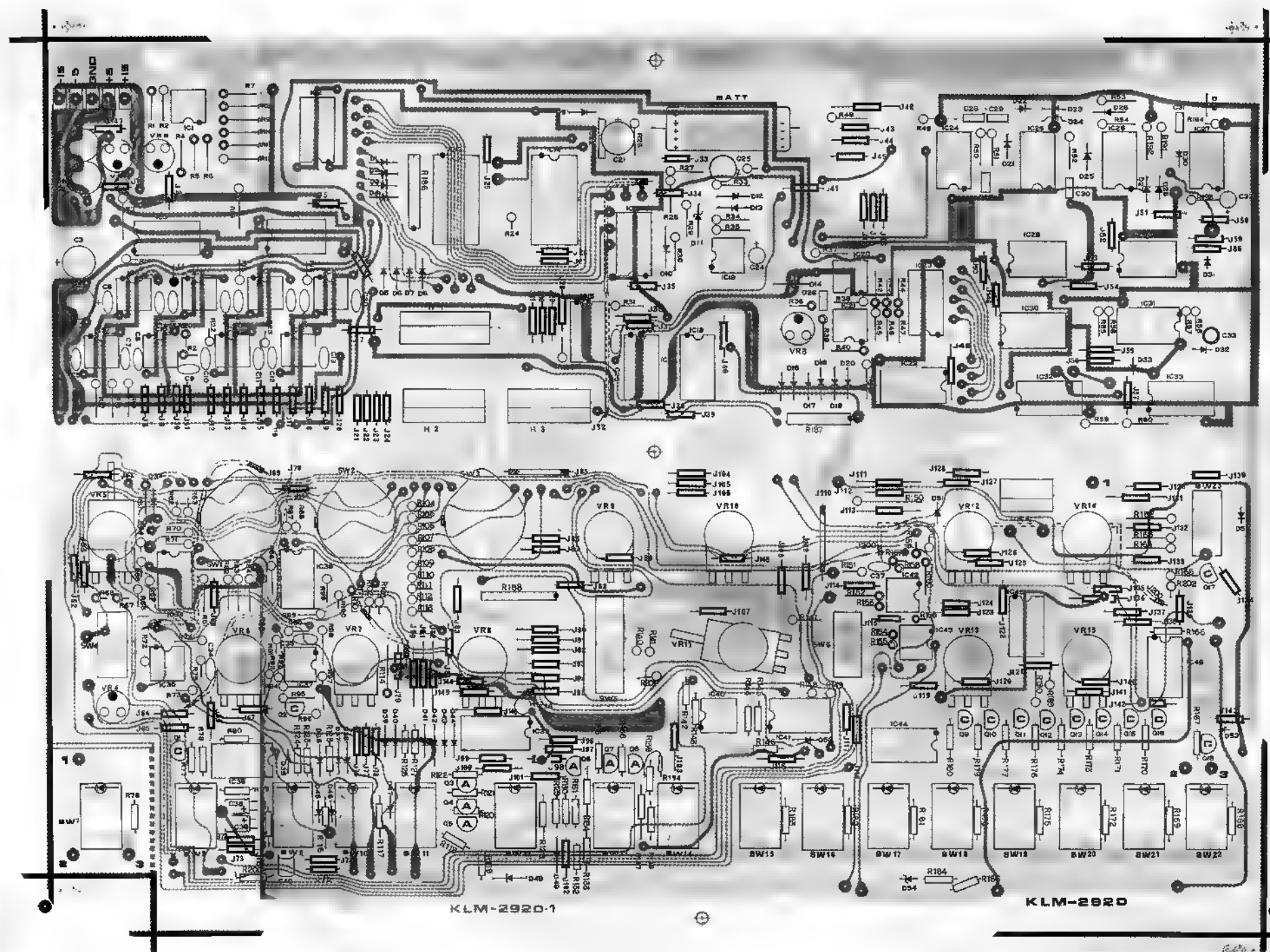
KLM-293 BRASS
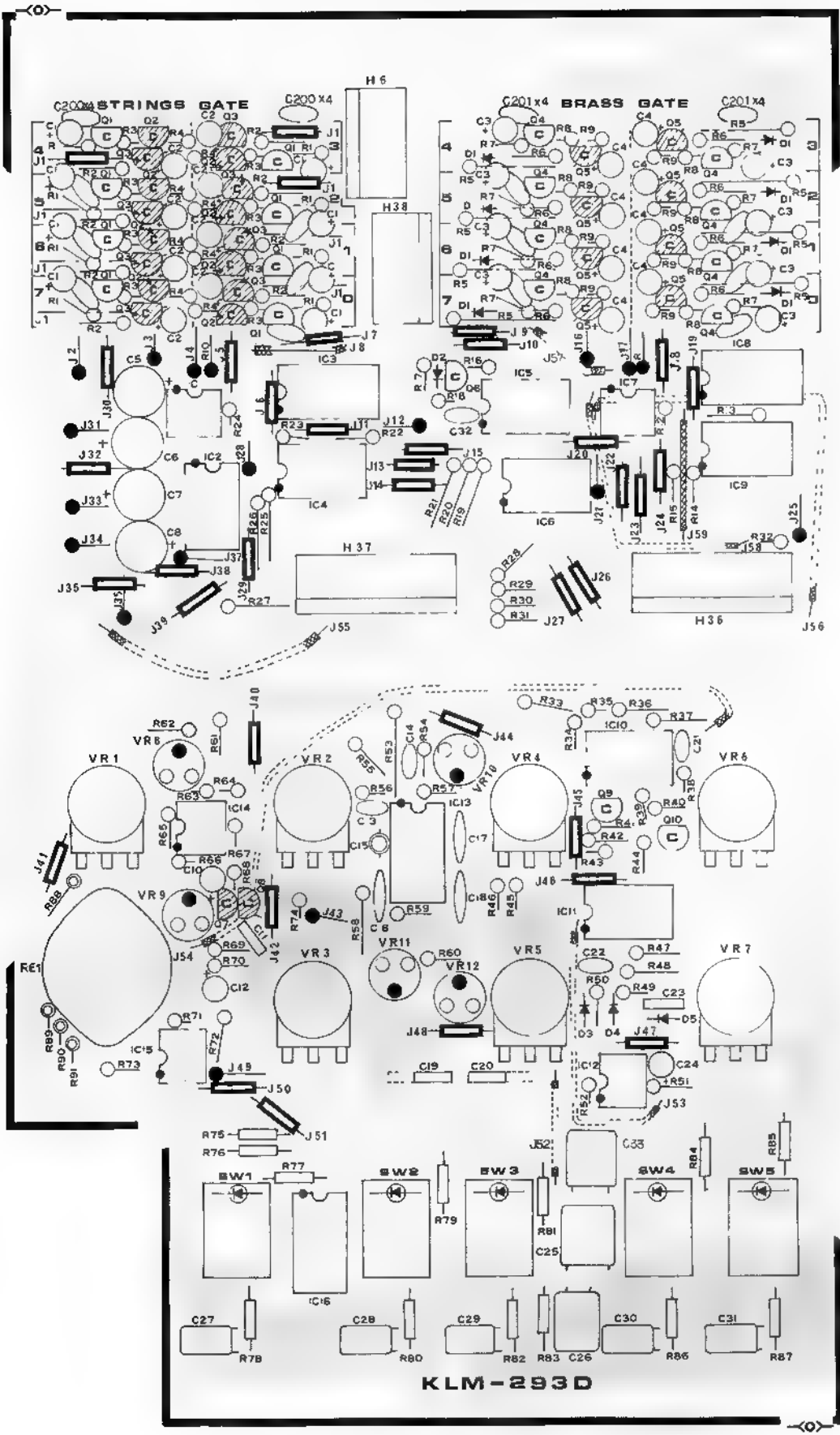
KLM-294 STRINGS (OLD PRODUCTION)

KLM-293D
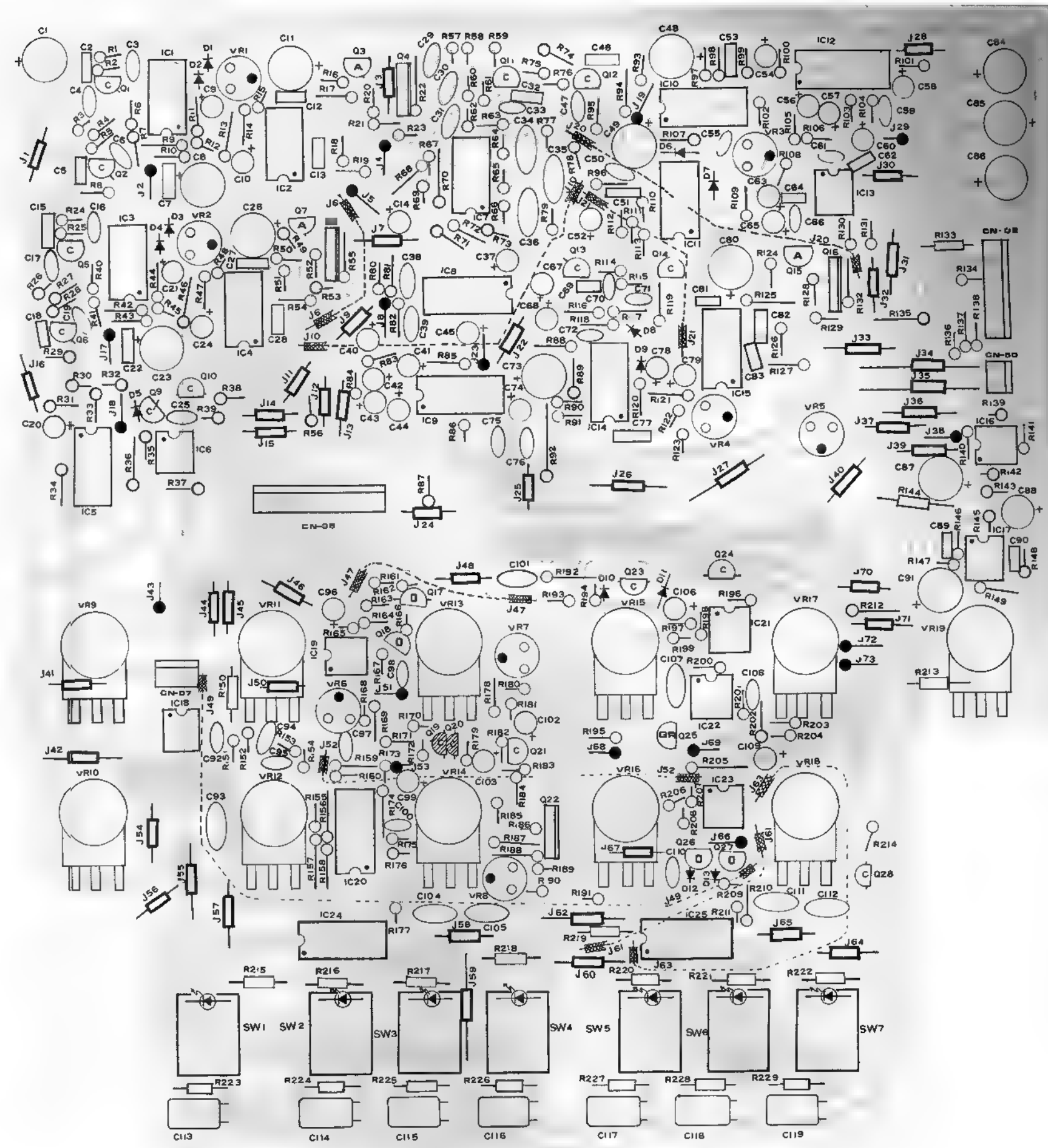
KLM-294F

KLM-294 STRINGS (NEW PRODUCTION)

KLM-343

KLM-300 ASSIGNER

KLM-301

KLM-300C

KLM-301C

KLM-341

KLM-340

KLM-297

-15V

FUSE
250V 0.5A

C1 C2

R8

-5V

D1

GND

VR1

C3 C4

+5V

R2 R3 R4 R5

+15V

FUSE
250V 0.5A

D10

D11

IC3

R6 R7

Q1

Q2

C5

D4

C6

C8

D5

C9

IC1

C12

C7

KLM-297D

C13

IC2

C10

C11

D6 D7 AC

GND

D8 D9 AC

R1

D2

D3

KLM-317

KLM 317C (PRESET)

(STRINGS VCF)

H 39

Fc

GND

CLAV   P ANO 2   PIANO 1

0 1 2 3 4 5 6 7

-15

+15

H 40

16
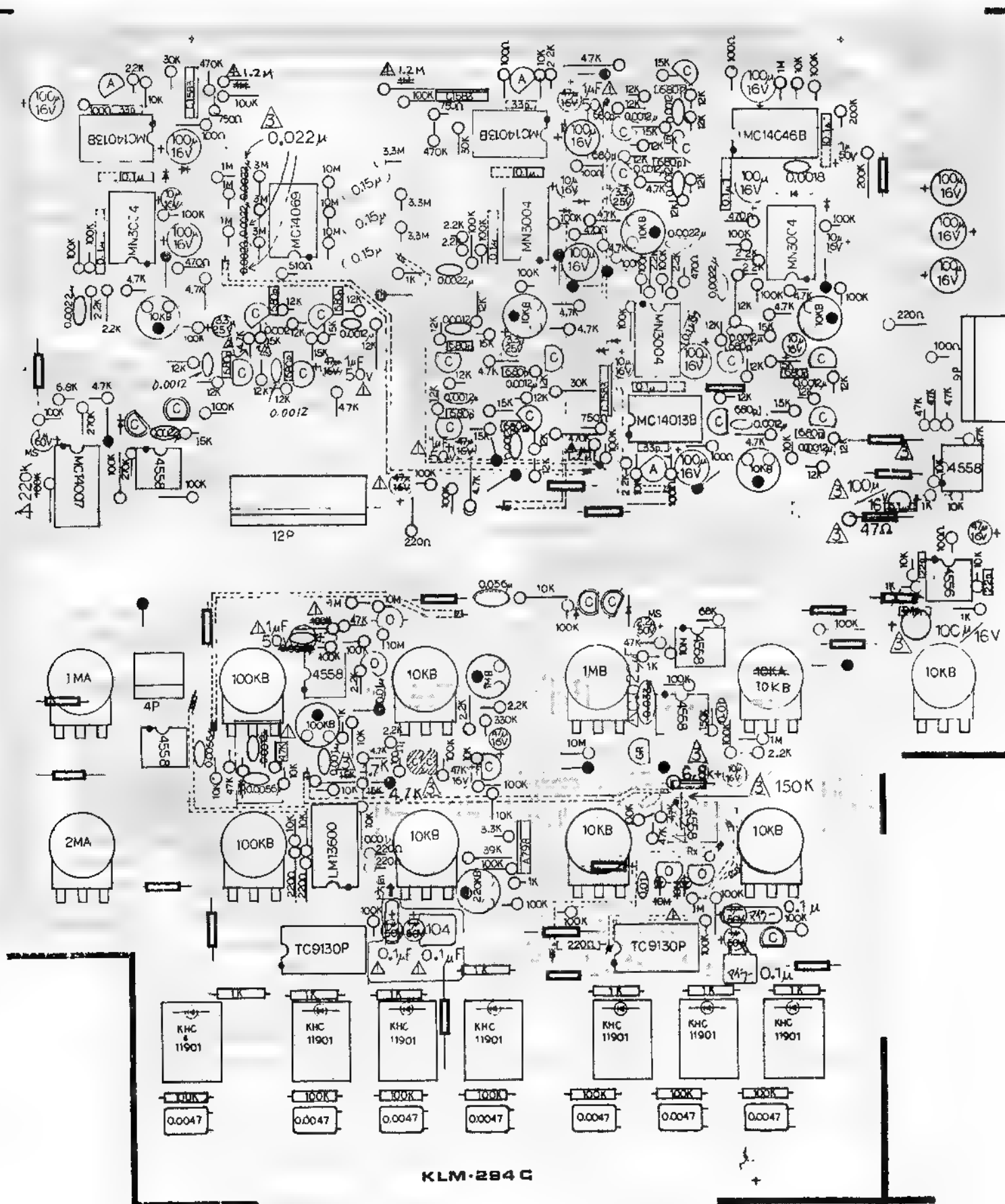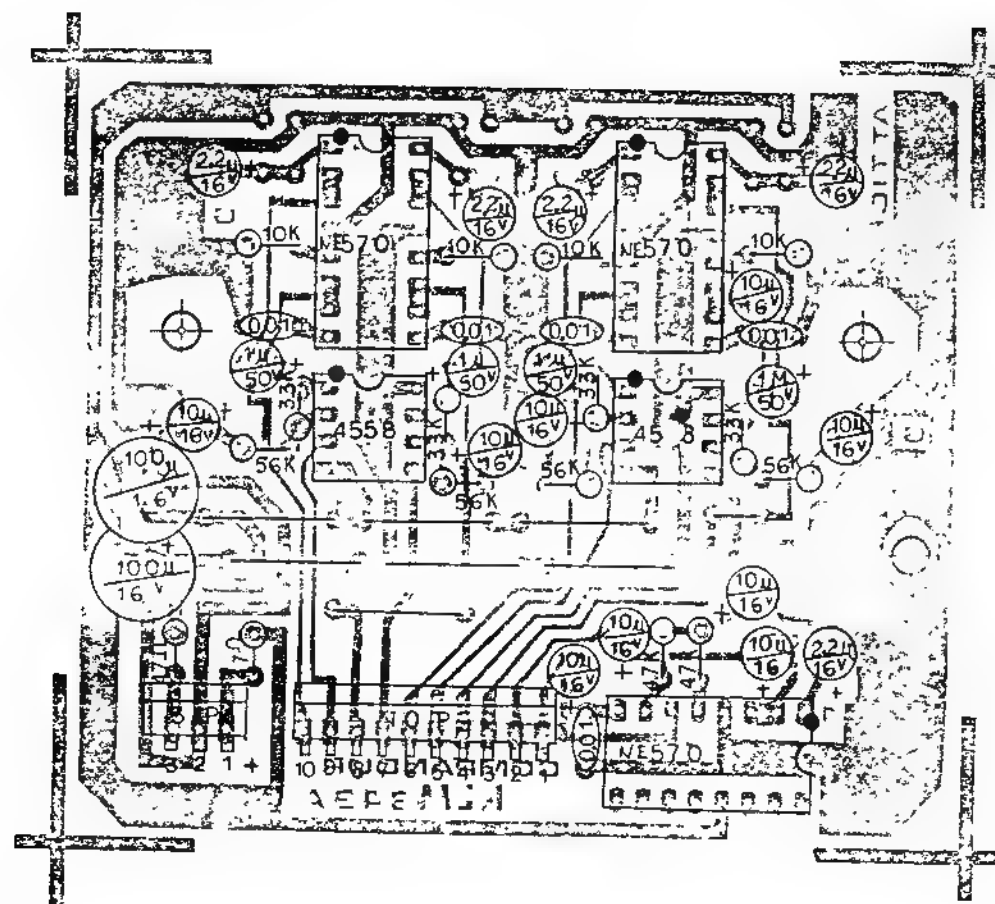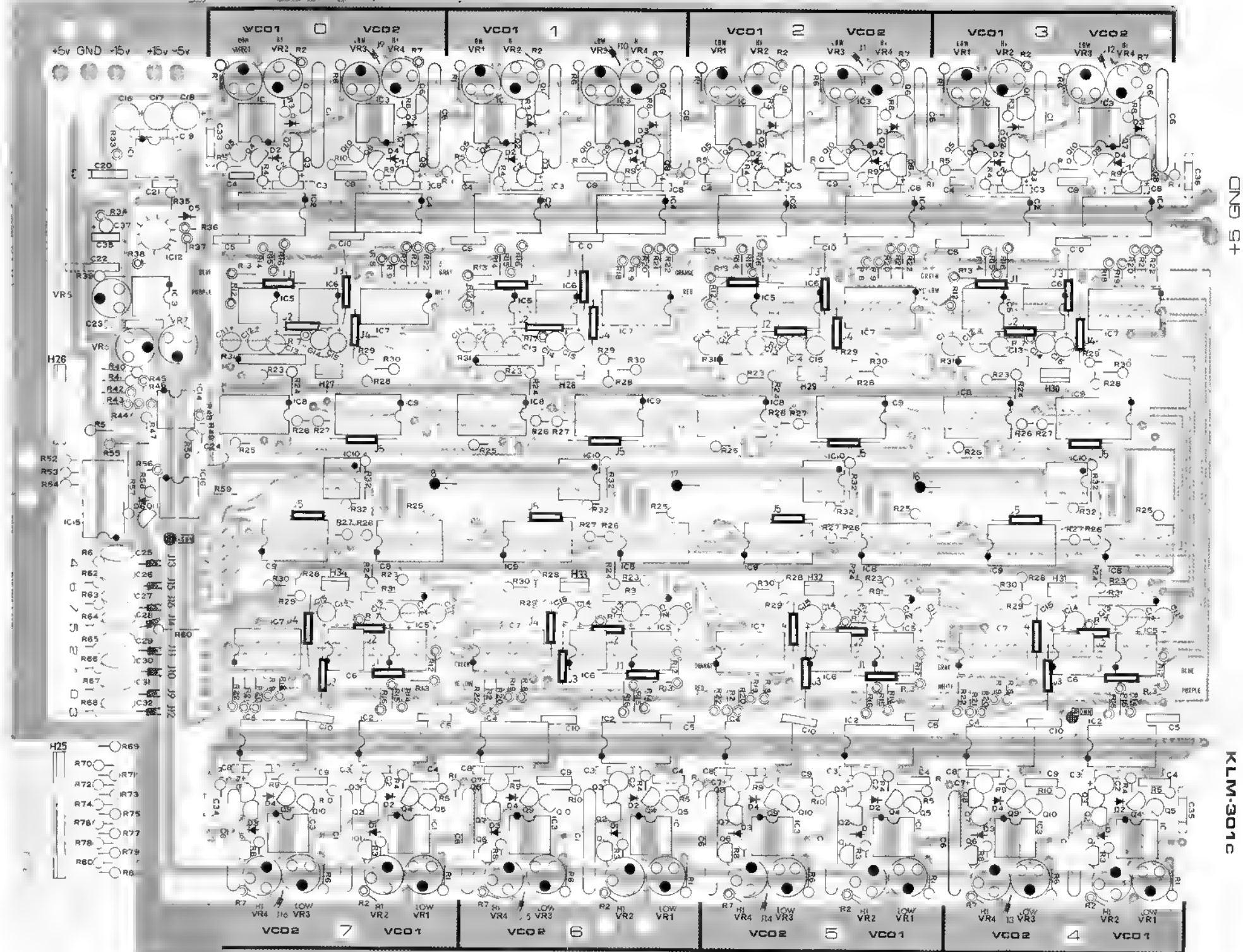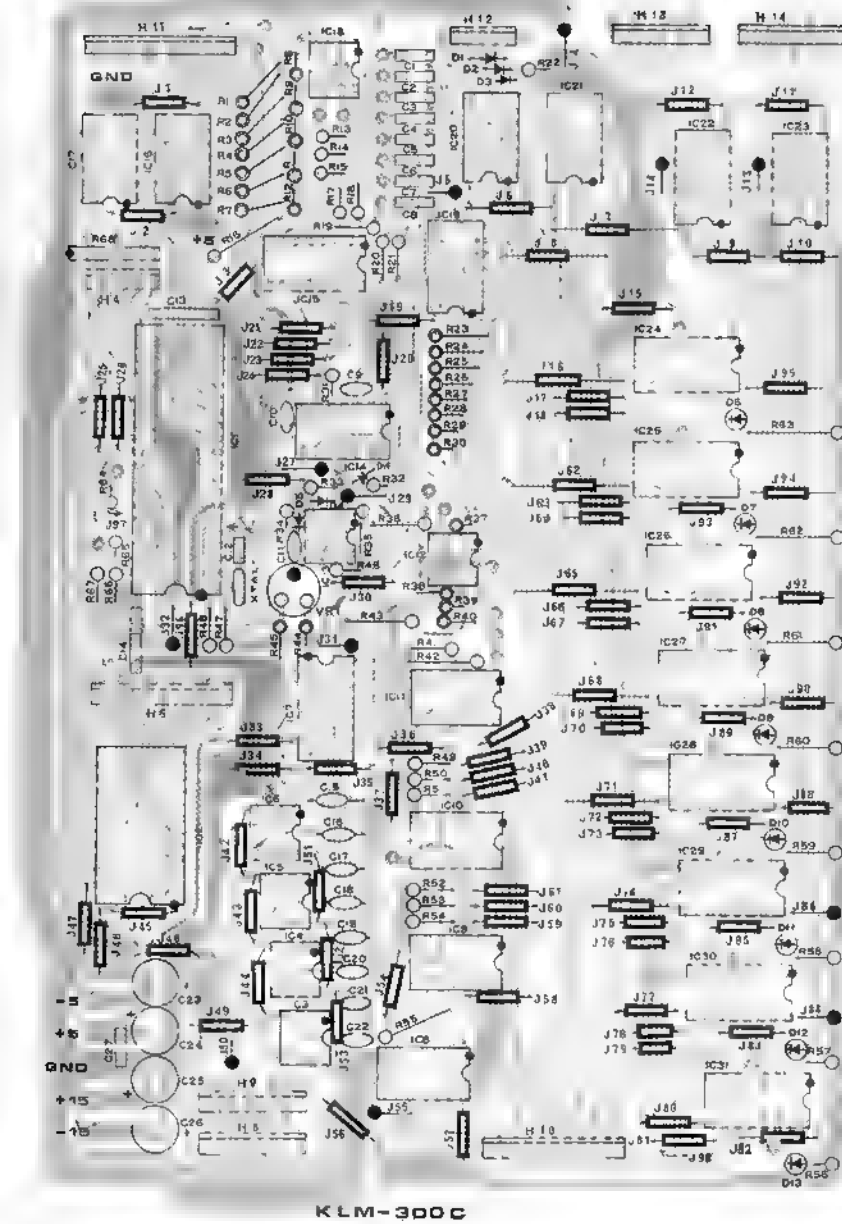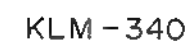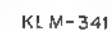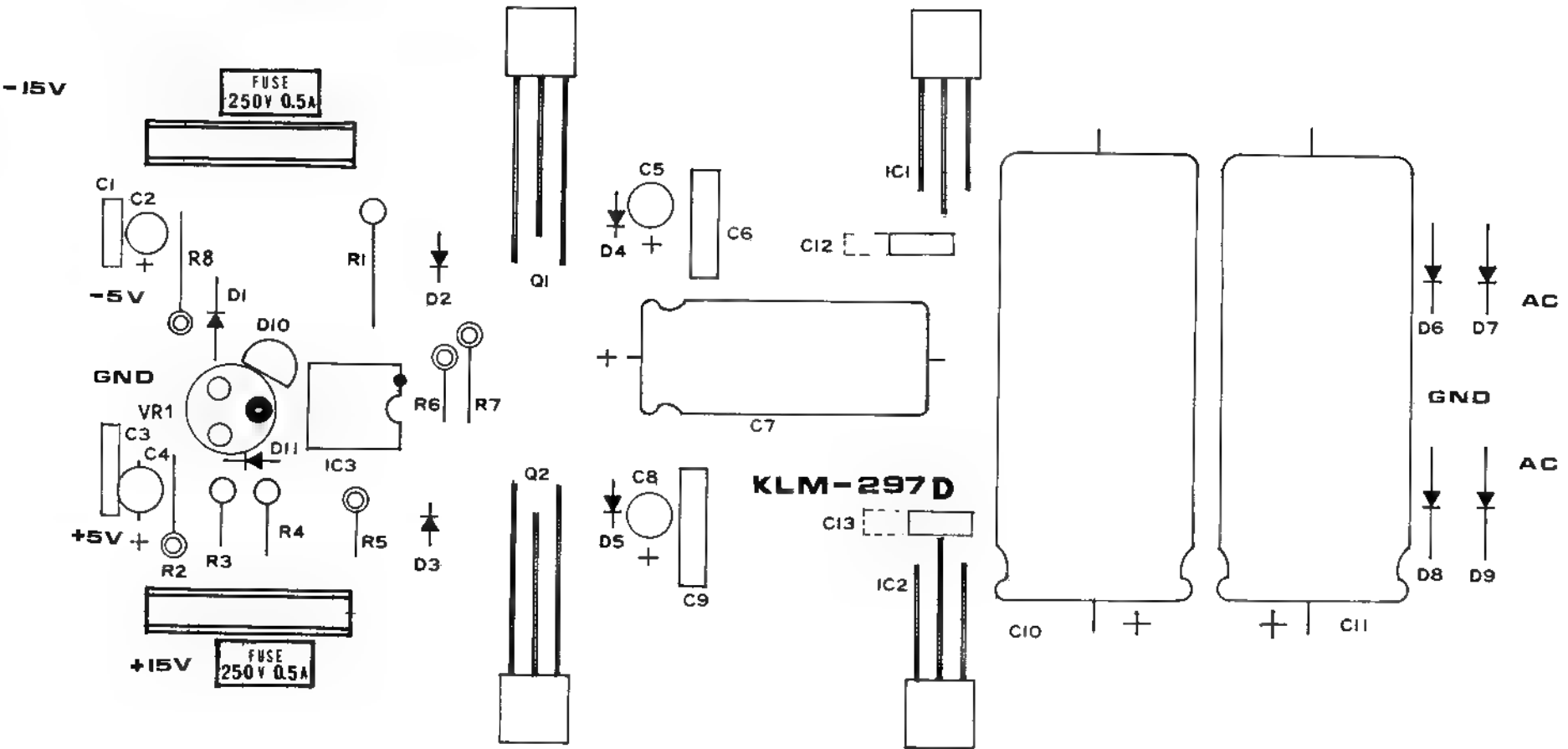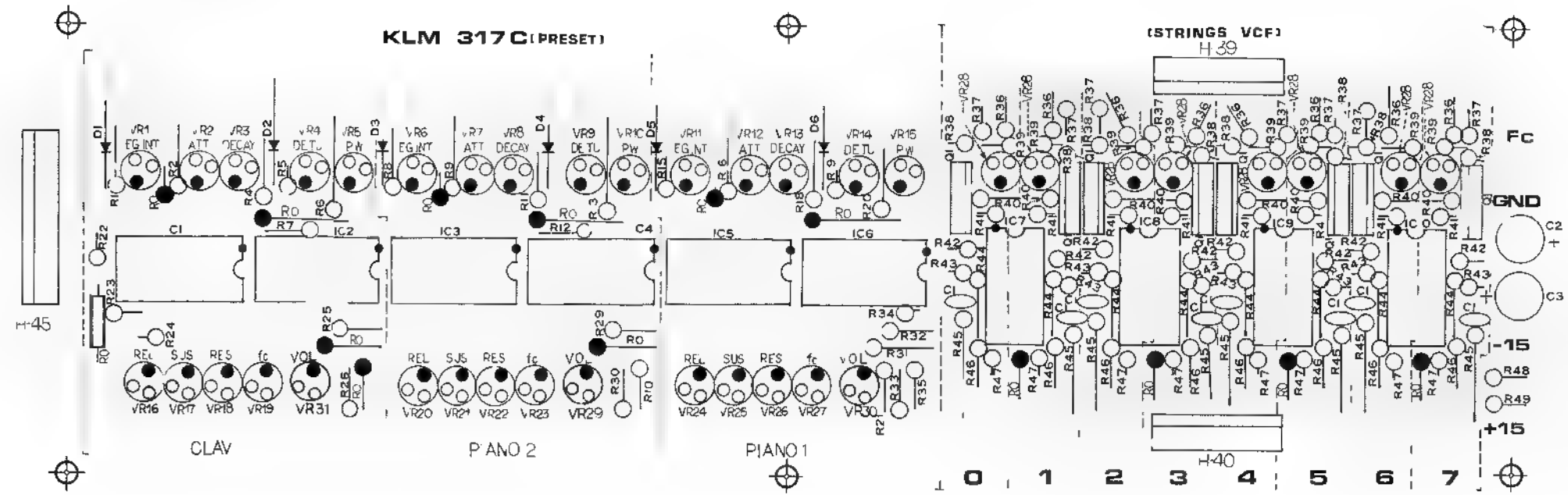
6. CONNECTOR FUNCTION

PCB	CONNECTOR	FUNCTION	CONNECTOR	COLOR
KLM-291	01 1	JOY-INT3	JOYSTICK	BR
	2	JOY INT 2 (CCW)	"	RE
	3	Y	"	OR
	4	X	"	YE
	5	JOY-SPEED 2	"	GR
	6	JOY INT 1 (CW)	"	BL
	7	JOY SPEED 3	"	PU
	8	YOY-SPEED 1 (CW)	"	GY
	9	+5V	"	WH
	10	-5V	"	BK
KLM-294	02- 1	-5V	CATHODE	BR
	2	GND	ANODE	RE
	3	GND	PHONE	OR
	4	PHONE OUT 1	"	YE
	5	PHONE OUT 2	"	GR
	6	MIX OUT	TOTAL VOL	BL
	7	IN PUT 3	"	PU
	8	" 2	"	GY
	9	" 1	"	WH
KLM-291	03 1	GND	MIXER VOL	—
	2	SY-SIG-OUT	"	BR
	3	GND	"	—
	4	BR-SIG-OUT	"	RE
	5	GND	"	—
	6	ST SIG OUT	"	OR
KLM-300	04- 1	X0	KLM 298	BK
	2	X1	"	BR
	3	X2	"	RE
	4	X3	"	OR
	5	X4	"	YE
	6	X5	"	GR
KLM 300	05- 1	M0	KEYBOARD	BK
	2	M1	"	BR
	3	M2	"	RE
	4	M3	"	OR
	5	M4	"	YE
	6	M5	"	GR
	7	M6	"	BL
	8	M7	"	PU
	9	M8	"	GY
	10	M9	"	WH
	11	M10	"	BK
KLM 293	06 1	ST SIG-7	KLM-317	PU
	2	" 6	"	BL
	3	" 5	"	GR
	4	" 4	"	YE
	5	" 3	"	OR
	6	" 2	"	RE
	7	" 1	"	BR
	8	" 0	"	BK
KLM 294	07- 1	-15	"	BL
	2	GND	"	BK
	3	+15	"	RE
	4	ST-CUTOFF FREQ	"	BR
KLM-300	08- 1	SY CV-0	15-3	BK
	2	" CV 1	16 3	BR
	3	" CV-2	17-3	RE
	4	" CV-3	18 3	OR
	5	" CV-4	19-3	YE
	6	" CV-5	20-3	GR
	7	" CV 6	21 3	BL
	8	" CV-7	22-3	PU
	09 1	ST CV 0	39 1	BK
	2	" CV-1	39-2	BR
	3	" CV 2	39 3	RE
	4	" CV-3	39-4	OR
	5	" CV-4	39-5	YE
	6	" CV-5	39 6	GR
	7	" CV-6	39-7	BL
	8	" CV 7	39 8	PU
	10- 1	ST-◄▷	48-3	BR
	2	ST ◄▷	48-2	RE
	3	ST- ▷	48-1	OR
	4	BR ▷	48 6	YE
	5	BR-◄▷	48-5	GR
	6	BR ▷	48-4	BL
	7	SY- ◄	48-9	PU
	8	SY- ◄▷	48-8	GY
	9	SY- ▷	48-7	WH
	10	BR-MPXG	37-10	BK
	11	ST-MPXG	37 12	PI
	11- 1	M PROTECT	42-10	BR
	2	MPX-CV	26-4	RE
	3	MPX-GATE	37-11	OR
	4	ASSIGN MODE	48-10	YE
	5	D	26 5	GR
	6	D	37-6	BL
	7	C	26-6	PU
	8	C	37 7	GY
	9	B	26-7	WH
	10	B	37-8	BK
	11	A	26-8	PI
	12	A	37 9	LB

PCB	CONNECTOR	FUNCTION	CONNECTOR	COLOR
KLM-300	12- 1	TOTAL-ORG	49-2	BR
	2	ST-ORG	35 3	RE
	3	SY-ORG	41-4	OR
	4	BR-ORG	36-3	YE
	5	Σ-BRG	36-7	GR
	13- 1	GATE 0	15-2	BK
	2	RC 0	15-1	"
	3	GATE 1	16-2	BR
	4	RC 1	16 1	"
	5	GATE 2	17-2	RE
	6	RC 2	17-1	"
	7	GATE 3	18 2	OR
	8	RC 3	18-1	"
	14- 1	GATE 4	19 2	YE
	2	RC 4	19-1	"
	3	GATE 5	20-2	GR
	4	RC 5	20 1	"
	5	GATE 6	21-2	BL
	6	RC 6	21 1	"
	7	GATE 7	22-2	PU
	8	RC 7	22 1	"
KLM-302	15- 1	RC 0	13-2	BK
	2	GATE 0	13-1	"
	3	SY-CV 0	08 1	"
	4	SY-SIG0	27-3	"
	5	SIG MIX 0	23-1	"
	16- 1	RC-1	13-4	BR
	2	GATE 1	13 3	"
	3	SY-CV 1	08-2	"
	4	SY-SIG1	28 3	"
	5	SIG-MIX 1	23-2	"
	17- 1	RC-2	13 6	RE
	2	GATE 2	13-5	"
	3	SY CV 2	08-3	RE
	4	SY-SIG2	29-3	"
	5	SIG MIX 2	23 3	"
	18- 1	RC-3	13-8	OR
	2	GATE 3	13-7	"
	3	SY-CV 3	08 4	"
	4	SY-SIG3	30-3	"
	5	SIG MIX 3	23 4	"
	19- 1	RC 4	14-2	YE
	2	GATE 4	14-1	"
	3	SY CV 4	08 5	"
	4	SY-SIG 4	31-3	"
	5	SIG MIX 4	23 5	"
	20- 1	RC 5	14-4	GR
	2	GATE 5	14-3	"
	3	SY-CV 5	08 6	"
	4	SY-SIG 5	32-3	"
	5	SIG-MIX 5	23 6	"
	21- 1	RC-6	14-6	BL
	2	GATE 6	14-5	"
	3	SY-SV6	08 7	"
	4	SY-SIG 6	33-3	"
	5	SIG-MIX 6	23 7	"
	22- 1	RC 7	14-8	PU
	2	GATE 7	14-7	"
	3	SY-CV 7	08 8	"
	4	SY-SIG 7	34-3	"
	5	SIG MIX 7	23-8	"
	23- 1	SIG MIX 0	15 5	BK
	2	" 1	16-5	BR
	3	" 2	17 5	RE
	4	" 3	18-5	OR
	5	" 4	19-5	YE
	6	" 5	20-5	GR
	7	" 6	21 5	BL
	8	" 7	22-5	PU
	24- 1	CUT OFF FREQ	42 4	BR
	2	VCA EG MODE	43-1	RE
	3	RESO NANCE	42-5	OR
	4	EG INTENSITY	43-3	YE
	5	KBD TRACK	42-8	GR
	6	ATTACK	43 4	BL
	7	DECAY	43-5	GY
	8	SUSTAIN	43-5	GY
	9	RELEASE	42-6	WH
	10	PRESET	42-9	BK
	11	PRESET VOLUME	43 10	PI
	12	GND	—	
	13	SY-SIG OUT (→291)	47-5	BR
KLM 301	25 1	PW/PWM	43 6	"
	2	ST-4'	35-4	RE
	3	BR-16'	36 9	OR
	4	VC02 OFF	43-9	YE
	5		42-7	GR
	6	BR 8'	36-10	BL
	7	ST-16'	35-6	PU
	8	ST 8'	35-5	GY
	9	VCO2 16'	42 1	WH
	10	VCO2 8'	42-2	BK
	11	VCO1 16'	43-7	PI
	12	VCO1 8'	43-8	LB

PCB	CONNECTOR	FUNCTION	CONNECTOR	COLOR
KLM-301	25 13	DETUNE	42-3	RE
	26- 1	TOTAL TUNE	47 1	BR
	2	DELAY VIB	49-6	OR
	3	MODULATION	49-5	YE
	4	MPX CV	11-2	RE
	5	D	11-5	GR
	6	C	11-7	PU
	7	B	11-9	WH
	8	A	11-11	PI
	27- 1	ST-SIG 0	40-8	BK
	2	BR "	38-8	"
	3	SY- "	15-4	
	28- 1	ST-SIG 1	40-7	BR
	2	BR- "	38-7	"
	3	SY- "	16-4	"
	29 1	ST-SIG 2	40-6	RE
	2	BR- "	38 6	"
	3	SY- "	17-4	"
	30- 1	ST-SIG 3	40-5	OR
	2	BR- "	38-5	"
	3	SY- "	18 4	"
	31- 1	ST-SIG 4	40-4	YE
	2	BR- "	38-4	"
KLM 301	31- 3	SY-SIG 4	19 4	YE
	32- 1	ST-SIG 5	40-3	GR
	2	BR- "	38-3	"
	3	SY- "	20-4	"
	33 1	ST-SIG 6	40-2	BL
	2	BR "	38 2	"
	3	SY- "	21-4	"
	34- 1	ST SIG 7	40 1	PU
	2	BR- "	38-1	"
	3	SY- "	22 4	"
KLM-294	35- 1	ST RELEASE	37-4	BR
	2	" -ATTACK	37-5	OR
	3	" ORG	12-2	RE
	4	" -4'	25-2	"
	5	" 8'	25-8	GY
	6	" -16'	25-7	PU
	7	" ON/OFF	46-1	YE
	8	T.S -SW	36-12	GR
	9	" ON/OFF	36-6	BL
	10	ST-SIG IN (→293)	37-1	OR
	11	GND	—	—
	12	ST-SIG OUT (→291)	46 2	OR
KLM-293	36 1	BR-SIG OUT (→291)	46 4	RE
	2	GND	—	—
	3	BR-ORG	12-4	YE
	4	BR-TRIG IN	JACK	OR
	5	NC	—	—
	6	T.S.-ON/OFF	35-9	BL
	7	ΣBRG	12-5	GR
	8	BR-TRIG OUT	JACK	YE
	9	BR-16	25-3	OR
	10	BR-8	25-6	BL
	11	BR ON/OFF	46-3	PU
	12	T S -SW	35-8	GR
	37- 1	ST-SIG OUT (→294)	35-10	OR
	2	GND	—	—
	3	BR-EXT fcM	JACK	GR
	4	ST-RELEASE	35-1	BR
	5	ST-ATTACK	35-2	OR
	6	D	11-6	BL
	7	C	11-8	GY
	8	B	11-10	BK
	9	A	11-12	LB
	10	BR-MPXG	10-10	BK
	11	MPX GATE	11-3	OR
	12	ST-MPXG	10-11	PI
	38- 1	BR SIG 7	34 2	PU
	2	" " 6	33-2	BL
	3	" " 5	32 2	GR
	4	" - 4	31-2	YE
	5	" - 3	30-2	OR
	6	" - 2	29 2	RE
	7	" - 1	28-2	BR
	8	" - 0	27 2	BK
KLM-317	39 1	ST-CV 0	09-1	"
	2	" " 1	09 2	BR
	3	" " 2	09-3	RE
	4	" " 3	09-4	OR
	5	" " 4	09-5	YE
	6	" " 5	09-6	GR
	7	" " 6	09-7	BL
	8	" " 7	09-8	PU
	40- 1	ST-SIG 7	34-1	"
	2	" " 6	33 1	BL
	3	" " 5	32-1	GR
	4	" " 4	31 1	YE
	5	" " 3	30-1	OR
	6	" " 2	29-1	RE
	7	" " 1	28-1	BR
	8	" " 0	27-1	BK
KLM-292	41- 1	SY EXT fcM	JACK	RE

PCB	CONNECTOR	FUNCTION	CONNECTOR	COLOR
	2	SY-ON/OFF	47-6	YE
	3	DAMPER	JACK	BR
	4	SY-ORG	12-3	OR
	5	TO PROTECT	SW	WH
	6	FROM PROTECT	SW	BK
	42- 1	VC02 16'	25-9	WH
	2	" 8'	25 10	BK
	3	DETUNE	25-13	RE
	4	CUTOFF FREQ	24 1	BR
	5	RESONANCE	24-3	OR
	6	RELEASE	24 9	WH
	7	⊓	25-5	GR
	8	KBD TRACK	24 5	"
	9	PRESET	24-10	BK
	10	M.PROTECT	11 1	BR
	43- 1	VCA EG MODE	24-2	RE
	2	DECAY	24-7	PU
	3	EGINT	24-4	YE
	4	ATTACK	24-6	BL
	5	AUSTAIN	24 8	GY
	6	PW/PWM	25-1	BR
	7	VCO 1 16'	25-11	PI
	8	" 8'	25-12	LB
	9V	VCO2 OFF	25 4	YE
	10	PRESET VOLUME	24-11	PI
	44- 1	PRESET-CLAV	45-1	BR
	2	" -PIANO 2	45-2	RE
	3	" PIANO 1	45-3	OR
	4	" -DATA	45 4	YE
	5	" -INH 2	45-5	GR
	6	" -INH 1	45 6	BL
	7	" -C	45-7	PU
	8	" -B	45 8	GY
	9	" A	45-9	WH
	10	" +5V	45-10	BK
	11	" 5	45-11	PI
KLM-317	45- 1	PRESET-CLAV	44 1	BR
	2	" PIANO 2	44-2	RE
	3	" -PIANO 1	44 3	OR
	4	" DATA	44 4	YE
	5	" -INH 2	44-5	GR
	6	" -INH 1	44 6	BL
	7	" -C	44-7	PU
	8	" -B	44 8	GY
	9	" -A	44-9	WH
	10	" +5V	44 10	BK
	11	" - -5V	44-11	PI
KLM 291	46- 1	ST-ON/OFF	35-7	YE
	2	ST-SIG IN←294	35-12	OR
	3	BR-ON/OFF	36 11	PU
		BR-SIG IN ←293	36-1	RE
	47- 1	TOTAL TUNE	26-1	BR
	2	SY-EXPRESSION	JACK	BL
	3	ST- "	JACK	GY
	4	BR "	JACK	PU
	5	SY-SIG IN	24-13	BR
	6	SY-ON/OFF	41-2	YE
	48- 1	ST- ▷	10-3	OR
	2	" ◄▷	10-2	RE
	3	" ◄▷	10-1	BR
	4	BR ▷	10-6	BL
	5	" ◄▷	10-5	GR
	6	" ◄▷	10-4	YE
	7	SY ▷	10-9	WH
	8	" ◄▷	10-8	GY
	9	" ◄▷	10-7	PU
	10	ASSING MODE	11-4	BK
	49- 1	VIB INT 2	VR GND	BK
	2	TOTAL-ORG	12-1	BR
	3	VIB INT 1	VR-CW	RE
	4	VIB INT 3	VR-CNT	BR
	5	MODULATION	26-3	YE
	6	DELAY VIBRATO	26-2	OR

COLOER
BR= BROWN
RE= RED
OR= ORANGE
YE= YELLOW
GR= GREEN
BL= BLUE
PU= PURPLE
GY= GRAY
WH= WHITE
BK= BLACK
PI= PINK
LB= LIGHT BLUE

FUNCTION
SY= SYNTHE
BR= BRASS
ST= STRINGS

7.SEMI-FIXED RESISTORS DIAGRAM
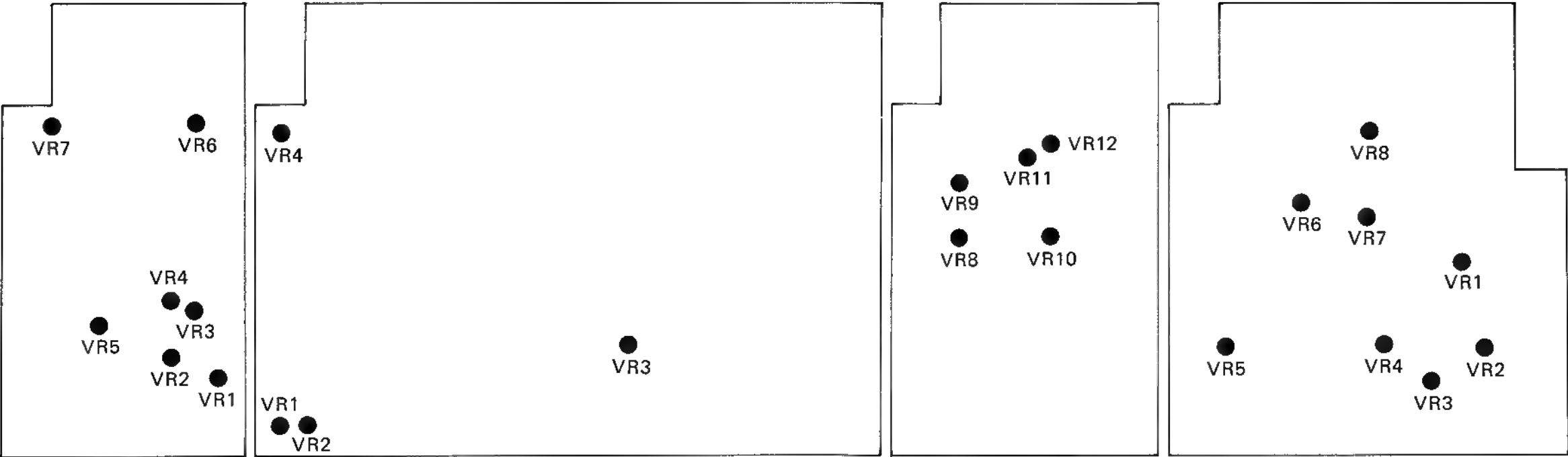
KLM-291

VR7 · VR6 · VR4 ·
VR4 · VR3 · VR5 · VR2 · VR1 ·

KLM-292

VR4 · VR3 · VR1 · VR2 ·

KLM-293

VR12 · VR11 · VR9 · VR8 · VR10 ·

KLM-294

VR8 · VR6 · VR7 · VR1 · VR5 · VR4 · VR2 · VR3 ·

VR1 ~ VR15

VR28

VR16 ~ VR30   0 1 2 3 4 5 6 7   KLM-317

KLM-297

VR1 ·

KLM-300

LED
7
6
5
VR1 ·
4
3
2
1
0

KLM-302

VR6 · VR7
VR5
VR4
VR3
VR2
VR1   ″ ″ ″ ″ ″ ″ ″

VR9
VR8

0 1 2 3 4 5 6 7

KLM-301

VR1 VR2 0 VR3 VR4   1   2   3

VR5
VR7
VR6   ″   ″   ″

VR4 VR3 VR2 VR1
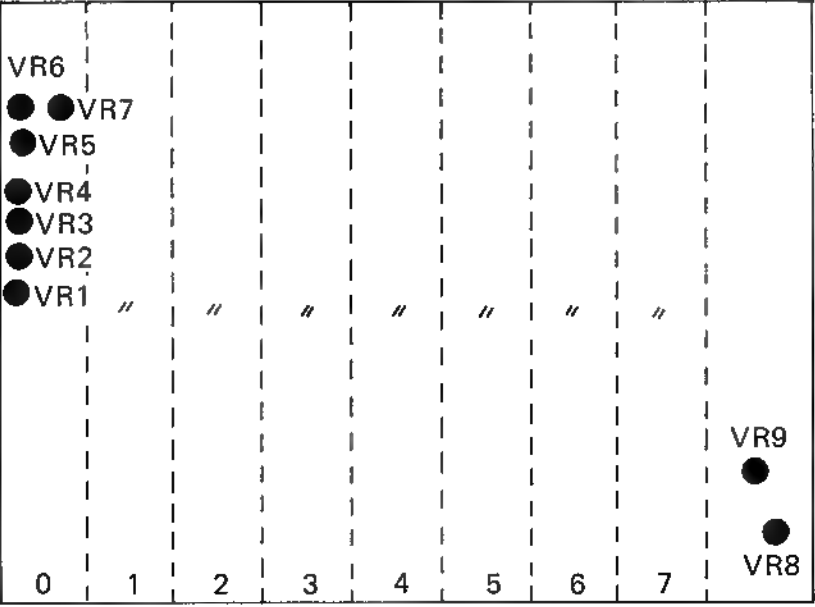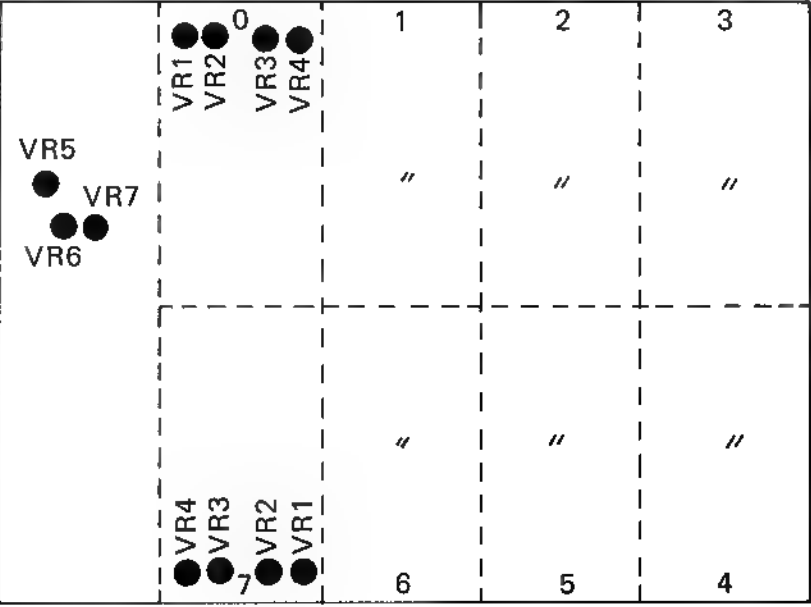7   6   5   4

18
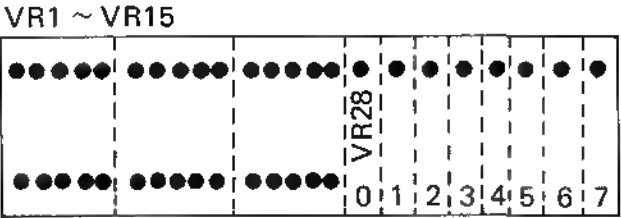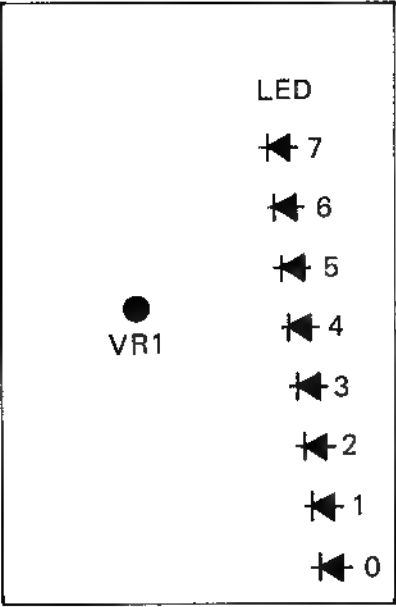
8.ADJUSTMENT PROCEDURE

Note: This instrument has been precisely adjusted at the factory. Therefore, do not change the position of any variable resistors other than those necessary for servicing.

1. Power supply (KLM-297)

(1) Use a digital multi-meter to check power supply leads (possible on any of the circuit boards) which should measure +15V (±14.7 ~ ±15.8V) and ±5V (±4.7V ~ ±5.3V).

(2) Check KLM-301 +5V (above ground) directly with a digital multi-meter and adjust VR-1 to obtain 5.000V (±0.001V).

(3) Also ascertain that the -5V supply is -4.995 ~ 5.005V.

2. Key assigner (KLM-300)

(1) Assign mode: Switch away from test position, then reset before proceeding
   1) At assign mode 1, play one key at a time and ascertain that the LEDs light up in the order: $D_1 \sim D_8$
   2) At assign mode 2, play two or more keys at once, then release them and ascertain that the LEDs light up beginning from the position of the last key released.

(2) KBD SPLIT: Check each section (synthe, brass, strings) as follows
   1) KBD SPLIT at ◄ ▷ — all 61 keys sound.
   2) KBD SPLIT at ◄ — only lower two octaves sound.
   3) KBD SPLIT at ▷ — only upper three octaves sound.
   4) Check to see that there is a clear and accurate split between C3 and B2 for all 8 units. If not, adjust VR-1 as necessary.

3. Programmer (KLM-292)

(1) With EG INT (EG INTENSITY) at 0, adjust VR-1 so that EG INT CV (302-24-4 or 292 43-3) is 0.00V (±60mV).

(2) With EG INT at -5, adjust VR-2 so that the EG INT CV is +5.00V (+60mV)

(3) With EG INT at +5, ascertain that EG INT CV is -5.00V (±60mV).

(4) Adjust VR-3 if these tolerances cannot be met.

(5) Reset EG INT to standard 0 setting after adjustment.

(6) PW/PWM CV adjustment
   Set VCO 1 scale to 16', waveform to PW, and PW/PWM to 10. Use a digital multi-meter to ascertain that PW/PWM CV (301 25-1 or 292-43-6) is 2.9V (±50mV). Adjust VR-4 if necessary.

4. Synthesizer (KLM-302)

(1) Offset check and adjustment
   1) Set VCO waveform to ⎍, set cutoff frequency to 0 (and set other controls to standard settings). Check SY-SIG OUT (302-24-13) with oscilloscope (0.1 sec/cm, 50mV/cm).
   2) Play any single key and ascertain that the DC output pulse is within ±50mV for units 0~7.

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   3) If tolerances are not met, set assign mode to 2, and adjust VR-1 for the unit in question.
   4) After finishing, return assign mode to 1 and cut off frequency to 10.

(2) VCA check and adjustment
   1) Set VCO 1 waveform to ⎍ and check SY-SIG OUT (302-24-13) with an oscilloscope (1 msec/cm, 0.65V/cm).
   2) Play key C3 and ascertain that sawtooth waveform amplitude is 0.65Vp-p (±0.05V) for units 0~7.
   3) If tolerances are not met, adjust VR 4 for the unit in question.
   4) After finishing, set waveform to PW.

(3) Resonance adjustment
   1) Set PW/PWM to 10, cutoff freq to 5, and resonance to 8. Measure cutoff freq CV (302-24-1) with a digital multi meter and adjust cutoff freq and cutoff freq fine to obtain 0mV (+10mV).
   2) Measure resonance CV (302-24-3) with the multi-meter and adjust resonance to obtain 8.00V (±80mV).
   3) Measure SY-SIG OUT (302-24-13) with an oscilloscope (1 msec/cm, 0.15V/cm). Play any single key and ascertain that the VCF waveform amplitude (sine wave) is 0.15Vp-p (+10mV)
   4) If tolerances are not met, adjust VR-3 for the unit in question.

(4) Cutoff frequency adjustment
   1) Set resonance to 10, PW/PWM to 10, and cutoff freq to about 6.3 (ascertaining that this gives 0mV ±10mV). Measure SY-SIG OUT (302-24-13) with an oscilloscope (1msec/cm, 0.1V/cm) and a frequency counter.
   2) Play any single key and adjust VR 2 so that the filter oscillation frequency (measured with WT-12) is C~523Hz for units 0~7.
   3) Adjust cutoff freq and cutoff freq fine to obtain 3.00V (±10mV) for the cutoff freq CV (302-24 1).
   4) Play any single key and adjust VR-7 for units 0~7 to obtain C=4186Hz for the filter oscillation frequency.
   5) With cutoff freq CV (302-24 1) at 0mV (+10mV), adjust cutoff freq fine to obtain C~523Hz for the oscillation frequency of unit 0.
   6) Repeat steps 2 through 5 as many times as necessary to reduce deviation to within ±5 cents

(5) KBD TRACK adjustment
   1) Set KBD TRACK to FULL, PW/PWM to 10, cutoff freq to about 6.3, and resonance to 10.
   2) Play G3 and adjust cutoff freq fine to obtain C=523Hz (measured with WT-12) for the oscillation frequency of unit 0.
   3) Adjust VR-2 for units 1~7 so that each unit's oscillation frequency is C~523Hz, under the same conditions as above.

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   4) Play G4 and adjust VR 5 for units 0~7 so that each unit's oscillation frequency is C~1109Hz.
   5) Repeat steps 3 and 4 as many times as necessary to reduce deviation to within ±5 cents.
   6) Check from C1 through C6 by ear to make sure it sounds approximately like a scale. (No need to use WT-12.)
   7) Set KBD TRACK to HALF and check to see that it changes to a 1/4 scale.
   8) After finishing, switch KBD TRACK to OFF.

(6) EG INTENSITY check and adjustment
   1) Set cutoff frequency to 0, EG intensity to +5, PW/PWM to 10, and resonance to 10. Check SY SIG OUT with an oscilloscope (20μsec/cm, 0.1V/cm) and a frequency counter.
   2) Play any single key and ascertain that the oscillation frequency for units 0~7 is 5 5kHz~6.0kHz. If not within these tolerances, adjust VR 6
   3) After finishing, set EG INT to 0, cutoff freq to 10, PW/PWM to 5, and resonance to 0.

(7) EG check and adjustment
   1) Set attack to 10 and sustain to 0. Play any eight keys simultaneously and ascertain that the attack time is 20~25 seconds. If not within these tolerances, use a digital multi-meter to measure the potential difference between the +5V power supply and the attack common line (the chart pattern closest to the keyboard side). Adjust VR-8 in accordance with the chart in figure 1.
   2) Set attack to 0, decay to 10, and sustain to 0. Play any single key and ascertain that the decay time is 20~30 seconds. If not within these tolerances, use a digital multi-meter to check the potential difference between the +5V power supply and the decay common line (the chart pattern after attack). Adjust VR 9 in accordance with the chart in figure 1.
   3) With attack at 0 and decay at 0, turn sustain from 0 to 10 and check to see that there is a smooth change in sustain level for units 0~7.
   4) Set attack to 0, decay to 0, and sustain to 0. With release time at about 5 seconds, there should be no greater than about 1 second error between units.
   5) After finishing, return release to 0 to return to the standard setting.

(8) Presets
   1) Play keyboard, using piano 1, 2, and clav.
   2) Based on the data on the following page, check and adjust test points on the page after next. Adjust circled points only; others should only be checked. Adjustment voltages are valid up to two places.

Figure 1. Attack and decay voltage values vs. temperature.
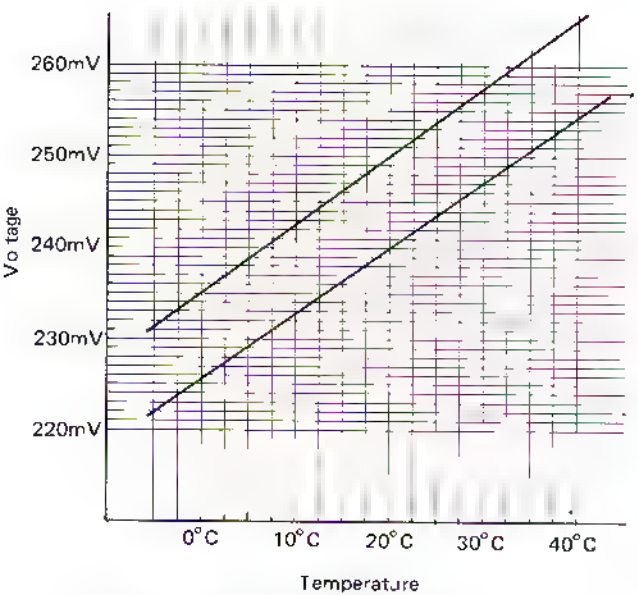
Tolerance. Within ±1mV of value on graph

[V]

Test point		PIANO 1		PIANO 2		CLAV	
1	VCO2 SCALE	+1.25	4'	+5	OFF	+5	OFF
2	VCO1. WAVE FORM	-1.25	PW	-1.25	PW	-1.25	PW
3	VCO1.SCALE	0	8'	-5	16'	-5	16'
④	PRESET VOL	+2	4	+2	4	-2	2
⑤	PW/PWM	-5		-3.95		(+2.6V)	
6	KBD TRACK	+5	HALF	-5	FULL	0	OFF
7	LFO SPEED			-10 (LOW SPEED)			
⑧	DETUNE	0		0		0	
⑨	SUSTAIN	5		-5		4.3	
⑩	RESONANCE	+5		+3.07		+5	
⑪	CUTOFF FREQ	+2.74		+1 94		+3.86	
⑫	RELEASE	+0.64		+0 18		-5	
⑬	DECAY	* 1		-5		-5	
⑭	EG INT	+0.65		-0.66		-0 8	
⑮	ATTACK	+3.2		+5		+5	
16	EG MODE			+5 ⎍			

O: Need adjustment.
Others require check only
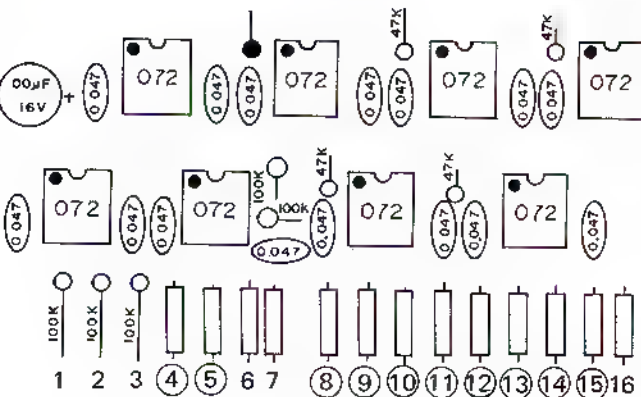
KLM 292

5. Brass (KLM-293)

(1) Offset check and adjustment

   1) Set cutoff freq to 0 and measure BR-SIG OUT (293-36-1) using an oscilloscope (0.1 sec/cm, 0.1V/cm).

   2) Play any single key and ascertain that the DC output pulse is within ±200mV.

   3) If not within tolerances, adjust VR-10.

     Note: Pulse output decreases if a key is played in rapid sequence. Therefore, leave at least a 5-second gap between playing the key.

(2) VCA check and adjustment

   1) Set scale to 8', cutoff freq to 10, and other controls to their normal settings. Measure BR-SIG OUT using an oscilloscope (1 msec/cm, 0.65V/cm).

   2) Play C3 and check sawtooth waveform output amplitude to ascertain that it is 0.65Vp-p (±0.15V) for units 0~7.

   3) If not within tolerances, adjust VR-9 for the unit in question.

(3) Resonance check and adjustment

   1) Set cutoff freq to 7 (leaving other controls at the normal settings) and use an oscilloscope (1msec/cm, 0.2V/cm) to measure BR-SIG OUT.

   2) Play any single key and check for a smooth increase in ringing with oscillation at 7~8 as you turn resonance up from 0 to 10.

   3) If oscillation does not occur at the right point, set scale 8', 16' to off, cutoff freq to 5, and resonance to 8. Then adjust VR-11 to obtain 0.65Vp-p for the resonance waveform amplitude.

(4) Cutoff FREQ check and adjustment

   1) Set scale 8', 16' to off and resonance to 10 (leaving other controls at the normal settings). Use a frequency counter to measure BR-SIG OUT (293-36-1).

   2) Play any key, set cutoff freq to 0 and check to see that f is 7Hz or lower. With cutoff freq at 5, f should be 180~200Hz. With cutoff freq at 10, f should be 5~6kHz.

     f = oscillation frequency

   3) If not within tolerances, set scale 8', 16' to off and resonance to 10; adjust VR-12 to obtain 180~200Hz when cutoff freq is at 5. Then adjust VR-8 to obtain 5~6kHz when cutoff freq is at 10.

## 6. Strings (KLM-294)

(1) Gate, filter check and adjustment

   1) Turn on both "vibrato off" and "ensemble off" and check to see that neither vibrato nor ensemble are applied to the sound.

   2) Use an oscilloscope (1 msec/cm, 0.1V/cm) to measure ST-SIG OUT (294-35-12).

   3) Set KBD filter balance to 10 and adjust VR-5 to obtain a sawtooth waveform amplitude of 0.6~0.8p-p for units 0~7.

   4) Check to see that there is a smooth reduction in waveform amplitude for units 0~7 when you turn KBD filter balance from 10 to 0.

   5) With KBD filter balance at 0, play C3 and check to see the sawtooth waveform amplitude is 0.2V ±0.05Vp-p for units 0~7.

   6) If not within tolerances, adjust VR-28 for the KLM-317 unit in question.

   7) After finishing, set KBD filter balance to 10.

(2) Bowing check and adjustment

   1) Turn on "bowing", "ensemble off" and "vibrato off" and use an oscilloscope to measure ST-SIG OUT (294-35-12).

   2) Play C3 and check to see that you obtain the following outputs with level and tone at the settings listed.

LEVEL=10
TONE =10
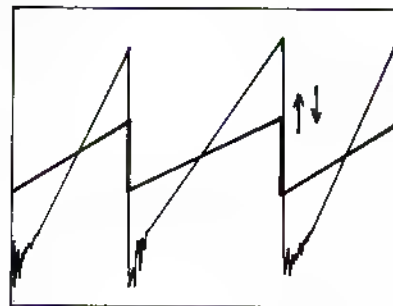
LEVEL= 0
TONE =10
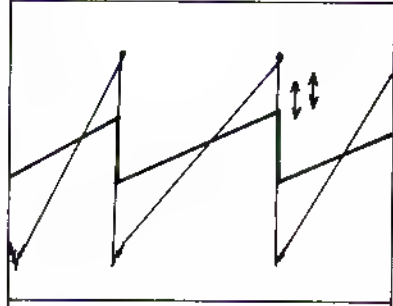
LEVEL= 5
TONE =3~4
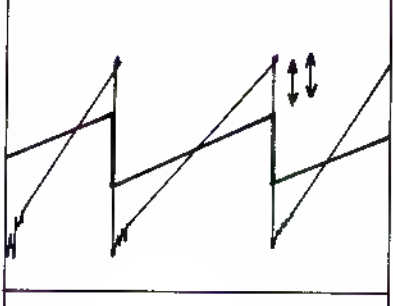
LEVEL=5
TONE =0
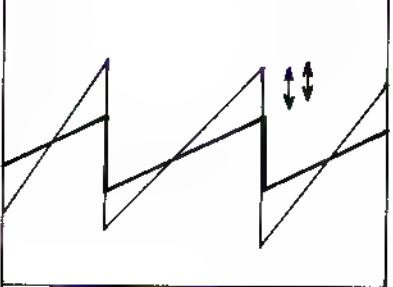
   3) If not within tolerances, adjust VR-6 (Q), VR-7 (gain), and VR-8 (f_o) as necessary.

   4) After finishing, set bowing to off, level to 10, and tone to 10.

(3) Bias level check and adjustment

1) Set scale to 8', bowing to on, level to 10, tone to 10, and KBD filter balance to 10, then check the following, playing eight or more notes together in the lower part of the keyboard.

2) Vibrato bias

Connect oscilloscope to Q11 (2SC945) emitter and check to see that the waveform is not distorted. Adjust VR-3 as necessary to eliminate distortion.

3) Ensemble 1 bias

Check for waveform distortion with oscilloscope connected to Q2 (2SC945) emitter. Adjust VR-1 if necessary to remove distortion.

4) For ensemble 2 and ensemble 3, check Q13 and Q6 and adjust VR-4 and VR-2, respectively, in the same way

7. Signal Generator (KLM-301)

(1) Antilog amp adjustment

1) Measure antilog output with a digital multimeter, connecting the GND side to −11V and the positive side to the exposed lead of R57 (47 ohms, connected to IC 4558 no.2 pin).

2) Play C3 eight times and adjust total tune to obtain 6.00mV (±0.1mV) antilog output. The total tune knob should be within ±1 scale marking of center.

3) Set VCO 1 scale to 4'.

1. Play C6 eight times and adjust VR-6 to obtain 4.800V (±0.003V)

2. Play C3 eight times and adjust VR 7 to obtain 600.0mV (±0.3mV).

3. Play C1 eight times and adjust VR-5 to obtain 150.00mV (±1mV).

4. Repeat steps 1 through 3 as many times as necessary to meet tolerances.

(2) VCO 1 tuning

1) Set assign mode to 2 and test with tuner.

2) Start with unit 0.

1. Play C6 and adjust VR-2 to obtain a 0 cent (±1 cent) reading.

2. Play C1 and adjust VR-1 to obtain a 0 cent (±3 cent) reading.

3. Repeat steps 1 and 2 above as many times as necessary to bring C2, C3, C4, and C5 with ±3 cents.

3) Repeat the above adjustments (1~3) for units 1~7.

(3) VCO 2 tuning

1) Set assign mode to 2 and test with tuner.

2) Set PW/PWM to 10 to eliminate the sound of VCO 1. Set VCO 2 scale to 4' and tune in the same was as for VCO 1.

(4) Stretch tuning

To be performed as follows after completing VCO 1 and VCO 2 tuning.

1) Play C6 and adjust VR-6 to obtain a +10 cent (±2.5 cent) reading for units 0~7.

2) Play C3 and adjust VR-7 to obtain a 0 cent (±2.5 cent) reading for units 0~7.

3) Play C1 and adjust VR-5 to obtain a −7.5 cent (±2 5 cent) reading for units 0~7.

4) Repeat steps 1 through 3 several times. It is not necessary to check other keys.

8. Flanger (KLM-291)

(1) Clock frequency check

1) Set intensity to 0 and use a frequency counter to measure the flanger's clock frequency (KLM-291 TP6 or 7).

2) Ascertain that frequency is 90~110kHz when manual is at 0, and 0.9~1.1kHz when manual is at 10. If not within tolerances, adjust V-3 (center frequency) and V-4 (fluctuation range) as necessary

(2) Mix level check

1) Set VCO 1 waveform to ⊓, apply flanger to synthe, and check synthe out with an oscilloscope (1 msec/cm, 0.1V/cm).

2) Play C4, set flanger intensity to 0, and turn manual from 0 to 10, confirming that the waveform just about disappears at about 4 (3~5).

3) If you don't get the kind of pattern shown in the above illustration and the ⊓ waveform still remains, turn manual, stopping at the point of minimum amplitude, then adjust VR-2 to further reduce amplitude to minimum.

(3) Feedback adjustment

1) Apply flanger to synthe, set both intensity and manual to 0, and check synthe out.

2) Turn feedback from 0 to 10 and ascertain that the flanger begins self-oscillation at or above 7 on the knob scale (without playing a key).

3) Adjust VR-1 if self-oscillation occurs at the wrong point.

9.PARTS LIST

PARTS NAME / SPECIFICATIONS	PARTS CORD	C'TY
CARBON RESISTORS (Not listed)		
SOLID RESISTORS		
1/4W 5 6MΩJ T	11103756	1
10MΩK T	11113810	21
BLOCK RESISTORS		
RKC1/8 B6 4.7KΩJ	13534470	1
B6 100KΩJ	13536100	9
B8 10KΩJ	13635100	1
B8 100KΩJ	13636100	2
LINEAR RESISTORS		
LR 30 1/8S 100ΩJ	13133100	2
1KΩJ	13134100	9
METAL FILM RESISTORS		
1/4W 100ΩF T	12613100	1
499	12613499	8
562	12613562	1
1.00KΩF	12614100	10
1 30	12614130	1
1.50	12614150	2
3.48	12614348	1
4 99	12614499	1
9.09	12614909	1
10.0	12615100	4
11.0	12615110	1
11.7	12615117	2
15 0	12615150	1
20.0	12615200	6
24.3	12615243	1
24.9	12615249	
30.1	12615301	1
39.2	12615392	1
40.2	12615402	2
41.2	12615412	16
46.4	12615464	1
49 9	12615499	18
63.4	12615634	1
75 0	12615750	1
80.6	12615806	2
100	12616100	55
130	12616130	8
160	12616160	2
162	12616162	32
187	12616187	8
200	12616200	36
205	12616205	1
232	12616232	8
124	12616124	1
267	12616267	2
301	12616301	2
324	12616324	2
383	12616383	1
392	12616392	8
487	12616487	1
576	12616576	1
649	12616649	2
1/4WC 1 00KΩ B T	12164100	4
100KΩ	12166100	10
200KΩ	12166200	7
SEMI-FIXED RESISTORS		
10 φ B220Ω (R)	35203122	1
470	35203147	1

PARTS NAME / SPECIFICATIONS	PARTS CORD	C'TY
2.2KΩ	35203222	1
4.7	35201247	17
10	35201310	32
15	35201315	9
22	35201322	11
47	35201347	3
100	35201110	21
220	35203122	11
1MΩ	35201510	13
6φ B 100KΩ	35001410	30
220	35001422	8
MYLAY CAPACITORS		
50V 0.001 μF K	20003410	14
0 0012	20003412	17
0.0018	20003418	1
0 0022	20003422	14
0 0033	20003433	18
0.0039	20003439	1
0 0047	20003447	17
0.0056	20003456	3
0.0082	20003482	2
0.01	20003510	17
0.012	20003512	1
0 022	20003522	30
0.033	20003533	1
0.047	20003547	32
0 056	20003556	3
0.068	20003568	1
0 1	20003610	14
0 15	20003615	3
ELECTROLYTIC CAPACITORS		
50V 1.0μF T	23015110	17
25V 3 3	23011133	11
16V 10	23007210	59
47	23007247	34
100	23007310	42
220	23007322	4
25V 470 Y	23111447	2
50V 0 22 T MS	23215022	1
0.47	23015047	16
1.0	23015110	9
	23015122	3
CERAMIC CAPACITORS		
50V 10PF F	21011210	2
22 K	21012222	3
33	21012233	3
100	21012310	11
150	21012315	3
220	21012322	1
330	21012333	12
470	21012347	9
680 KB	21106368	19
0.0047μF MD		32
25V 0 1μF ZFZ	21204610	66
STYROL CAPACITORS		
50V 1000PF GT	20502310	1
680	20502368	9
POLYSTYRENE CAPACITORS		
50V 6200PF GY	28001462	16

PARTS NAME / SPECIFICATIONS	PARTS CORD	C'TY	PARTS NAME / SPECIFICATIONS	PARTS CORD	C'TY
POLYPROPYLENE CAPACITORS			**LED**		
100V 0.015µF GT	26001515	27	PR 5534S (φ5)	31200700	1
IC			3432S (φ)	31200900	0
MC 14001 B	32020011	2	**RESONATORS**		
14007 UB	32020001	12	HC 18/U6.00MHZ	33500500	1
14011 B	32020002	6	**IC SOCKET**		
14013	32020022	21	40P	48001800	1
14023	32020010	5	**ELECTRIC BATTERY**		
14024	32020012	2	N-SB2	52000600	1
14028	32020005	2	**POTENTIONETERS**		
14042	32020018	9	EVH- 5LA802 A14	36011500	0
14044	32020039	1	B14	36009400	10
14046	32020036	1	C14	36011400	1
14050	32010014	2	A15	36005900	1
14051	32020015	14	B15	36005700	14
14066	32020009	40	A16	36006000	2
14068	32020035	3	B16	36006100	1
14069 UB	32020003	5	A26	36006200	3
14070	32020017	4	6LA802 B15	36012800	1
14174	32020028	1	COAK15 B14	36005300	4
14503	32020029	1	K164A0006A –10KB x 4	36202400	1
14514	32020030	1	K161A –10KA		0
14532	32020020	1	–10KB		2
LM 130600	32022093	4	E3JXCO3 10KB x 2	36201300	1
130600	32022091	9	**ROTARY SW**		
339 C	32021006	2	SRM –1034230	37001500	3
µPC 393	32001027	7	–1033	37002300	1
358	32002026	2	**TACT SW**		
NJM 4556	32009002	1	KHC - 11901	37503400	32
4558 DV	32009003	55	**SLIDE SW**		
CA 3140 E	32024004	2	SSB 12208	37001000	4
TL 071	32021013	17	12307	37301600	4
TL 072	32021011	21	12202	37301200	1
MN 3004	32002006	4	**FUSE**		
CA 3080 E	32024007	1	250V 0.5A	46300200	2
µPD 5101 C-E	32001017	2	2.0A	46300400	1
µA 726	32023004	1	**KEY BOARD**		
AN 829	32002015	2	ESK –3010	42001500	1
SAD 1024 A	32033001	1	**LNG BOARD**		
µPD 8048C-203	32001029	1	L-1205-6P	46001700	1
TC 9130P	32003004	3	**SPARK KITTER**		
SSM 2044	32029004	9	NSKE-135 350V 0.033µ 120Ω	21900100	1
µPC 14315H	32001005	1	**JOYSTICK VR MOUNTING BOARD**		
µA 7915 CKC	32021009	1	KOC-C40230	64026700	1
TRANSISTORS			**RUBBER FEET**		
2SA 733 AK	30000727	28	#5	50002100	4
798 G	30001007	25	**ROTARY KNOB**		
699 Q	30000317	1	18φ X-1936	62007600	45
2SC 945 L K	30200334	52	**SLIDE SW KNOB**		
		73	KOC-E40026	62001500	8
Selected	30200399	45			
1583 G	30201107	20			
1226 AQ	30200517	1			
2SK 30A TM-GR	30600232	19			
TM-O	30600115	16			
DIODES					
IS 1555	31000100	252			
1885	31000200	6			
ZENER DIODES					
RD 47 EB$_2$	31101000	1			
12	31101100	1			
LM 336 Z		1			

PARTS NAME / SPECIFICATIONS	PARTS CORD	C'TY
JOYSTICK KNOB		
KOC-E40035	62005300	1
TACT SW KNOB		
(DIC504) Dark Brown KOC-E30019	62001900	1
(547) Ivory	62002900	10
(158) Red	62003100	1
Green	62003200	3
Orange	62003400	9
Gray	62003300	8
SLIDE SW KNOB		
SSB ℓ=9m/m	62001800	1
RADIATION MASK		
KOC F40161	55003000	1
TACT SW MASK		
F40151	55002900	32
FUSE SEAL		
FUSE 2A KOC-F40057		1
KOC-F30013		1
SERIAL NUMBER PLATE		
KOC-F40050, H40001	58006500	1
PHONE JACK		
2P SG-7501	45000100	7
3P SG-7617	45000400	6
SG-7721	45001200	1
POWER SW		
1801-0121	37503800	1
P.C.B.		
KLM- 291	34014203	1
292	34014304	1
293	34014404	1
294	34014503	1
297	34014603	1
298	34014703	2
299	34014800	1
300	34014903	1
301	34015003	1
302	34015104	1
317	34016800	1
263	34013700	1
340	34017000	1
341	34017100	1
343	34017200	1
FRONT PANEL		
KOC-C20095	64047500	1
METAL FITTING OF FRONT PANEL(R)		
KOC-C30161	64033200	1
METAL FITTING OF FRONT PANEL(L)		
KOC-C30161	64033100	1
PHONEJACK PLATE		
KOC-C30160	64032700	1
METAL FITTING OF KLM297		
KOC-C40350	64032900	1

PARTS NAME / SPECIFICATIONS	PARTS CORD	C'TY
METAL FITTING OF KLM297		
KOC-C40350	64033000	1
MUSIC STAND		
KOC-C30162	64032800	1
WOODEN CASE		
KOC-D20021	64507100	1
CONTROL PANEL		
KOC-E40068	64605300	1
METAL FITTING OF CONTROL PANEL		
KOC-C40229	64026600	1

MEMO

MEMO